Seven Steps to Better Listening

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SEVEN STEPS TO BETTER LISTENING . . .

EDWARD TATNALL CANBY

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PLEASE READ BEFORE PLAYING THIS RECORD

This record is self-expanatory. The commentary-instruction (be you amateur or audiophile) will take you along the seven steps. However, if yours is a MONOPHONIC (NON-STEREO) pickup, do not play the grooves of side A. Turn at once to side B, which may be safely played with all pickups, monophonic and stereophonic. You should also know more about your pickup's present stylus-force —the "weight" of the arm on the stylus point—so read the comments for Tests 8 and 9 and make a stylus-force check as directed before you play any of the bands on either side. These tests are simple but important because too great a stylus-force may ruin the record before you have a chance to use it.

Reading completely through this book before playing your record will greatly add to your enjoyment of it.

This record is designed to help you obtain maximum performance from your phonograph, regardless of its cost. It is for the music listener and for the hi-fi enthusiast too, because it includes the effects of individual listening rooms upon the reproduced sound, and adjusts that sound to an objective standard at the ear. No test instruments are needed for this purpose—only your own ears and perceptions.

A word about the curious sounds you will hear on these tests. They were chosen after much research as those which elicit the most precise responses of your ears, while minimizing confusions caused by random room reflections.

You will hear a curious term—third-octave "pink noise." It is a sound midway between a steamy hiss and a true pitch, produced at many levels, both high and low. "Pink noise" is a relative of "white noise"—that roaring, steaming sound you hear between stations on your FM radio. "White noise" is a mixture of all sound frequencies (pitches) in which each separate frequency has the same energy content as every other; the analogy is, of course, to white light, which is a similar mixture of color frequencies.

The "pink noise" test tones in this recording are narrower than an octave—only a third of an octave wide from their lowest to their highest included frequencies. They are wholly unmusical, and yet they are distinctly related to musical sounds because they have a similar distribution of energy between high and low tones. And their texture is not only useful in making loudness comparisons—the key to our tests—but very helpful in "averaging out" your room's more violent effects (such as reflections) at specific frequencies, high or low.

So—open your ears and sharpen your senses. The more carefully you listen to this record, the more musical will be the sounds brought to you by your other records.

Test 1
Side A, Band 1 LEFT-RIGHT IDENTIFICATION

This preliminary test serves to check the left-right relationship of your two stereo sound-channels and to balance them in loudness. It will introduce you, as well, to the aforementioned third octave "pink noise" bands that are the basis of the succeeding tests.

Some amplifiers have channel-reverse switches by which you may shift sides without disconnecting or moving your loudspeakers. Even so, if your system is set up with speakers reversed, it might be wise, for sheer symmetry, to rearrange the speakers (or reverse their connecting cables) so that the right-left labels on your control panel read correctly.

Similarly, though a loudness adjustment can be quickly made via the stereo balance control, you may wish to make use of the input-level controls that are likely to be available on

your amplifier to reduce the louder channel so that the balance control itself may be set at the middle, or zero position, for correct balance. If there are no level-sets on your equipment, you may wish to mark the point of correct balance on the balance control itself. (Stereo from other sources—FM radio, tape recorders, other phono players—may balance at a different point, of course, due to differences in equipment and recordings.)

It is worth noting that in many stereo recordings the definition of left or right is purely arbitrary. Actors in recorded drama may enter stage-right instead of stage-left, jet planes and diesel trains will roar across your living room from left to right instead of the other way 'round, perhaps, or the banjo may change places with the folk guitar. Unimportant!

However, most orchestral music, notably the classical symphony from Haydn through Beethoven and Tchaikovsky, is based on the sound of the string orchestra. The important sound of the first violins, the "melody" string voice, traditionally has been heard from the left. Undoubtedly, this is so because of the instrument itself, which is heard to best advantage when the player sits with his right or bow arm towards the audience.

In the conventional arrangement, then, the higher string sounds are by long habit associated with the left side of the music as we face it. The lower-pitched sounds tend to be heard from the right of center with a smooth blend in-between via the intermediate pitched strings and, behind them, the woodwinds, brass and percussion.

Thus, to assist the home-based illusion of reality, we should orient our speakers with the correct right-left configuration.

A word of caution. Some stereo phonographs, both the large console models and some smaller machines with small separate "outrigger" speakers for the highs, blend together the very low bass from both channels. If yours is of this type, you will find no appreciable separation as to right and left among the tones in this test. All of them will appear to come from the same point in the central region. Nevertheless, you should try to adjust them for equal loudness.

(Very low frequencies do not contribute much to the stereo effect. Bass musical instruments are heard to right or left in stereo mainly because of their overtone coloration, which is in a higher frequency range.)

Test 2
Side A, Band 2 CHANNEL PHASING

This test is vital for stereo listening though, paradoxically, speaker phasing is often elusive even to the experienced listener.

What is phasing? Loudspeakers produce sound by "pumping" air, pushing it forward and back, and thus sending forth airwaves or sound vibrations in the air medium. Two loudspeakers reproducing an identical signal (a signal is any type of sound in its electrical

form) are said to be in phase when their vibrations, however complex, are exactly in step with each other, moving forward and back together, like marching feet. In this situation our ears hear the two speakers as a single one creating a phantom "virtual image" that seems to be located between the two actual speakers. If the two sources are equal in loudness (Test 1), the phantom single speaker will be heard exactly halfway between them. As volume is increased in one speaker or the other, the image appears to move to right or left.

If, however, the pair of leads (wires) to one of the speakers is reversed, the speakers are said to be out-of-phase; one moves forward as the other moves back, like soldiers out of step. The vibrations are identical but exactly opposite. We still hear the same sounds, the same voices or music. But try as we may, we are usually unable to create that central "virtual image" which is heard when speakers work together in phase.

Out-of-phase sounds, directed fanwise from the speakers, clash as they meet, canceling each other or blending erratically. Thus, we hear a peculiarly restless, unfocused effect, subtly unpleasant or even disturbing. As we move our heads, one speaker or the other may suddenly jump into prominence; an intermittent pressure may be felt, now in one ear, now in the other. These effects vary from person to person and do not readily lend themselves to verbal description—but once heard clearly, the out-of-phase effect is unforgettable.

Phase reversal is heard more strongly in some rooms than in others and may vary from place to place in your living room. In very "live" rooms the confusion of reflected sound may completely mask the effects of improper phasing—in which case the stereo effect itself is likely to be minimized too.

A helpful clue in phasing is an apparent loss of bass in the out-of-phase sound, as compared to that which is in phase. Although high tones (except the extreme highs) are subject to multiple room reflections, lower pitches are progressively less affected as they approach the bottom bass. Thus the opposed low-bass vibrations cancel each other out. The sound is as though your bass tone control had been moved towards less bass.

Why is speaker phasing important in stereo, where the two loudspeakers reproduce different sound channels?

The answer to this is simple. They are only partially different. The differences between channels are, so to speak, superimposed upon a solid base of similar or identical sounds. Every stereo record is thus part mono. You can confirm this by comparing the two channels via your balance control. They are more alike than different.

In terms of what you have already read, these similar or identical sounds must thus appear to come from between your speakers, as "virtual images." The rule holds in stereo too. All sounds that are identical and of equal volume must appear at the center of your home

"stage." Sounds which are near-identical, which are variably out-of-phase (one lagging slightly behind the other) and/or louder in one channel than the other (both these factors count) situate themselves variably to one side or the other of the center point.

Indeed, signals which combine out-of-phase relationships with strong volume-differences between the channels may appear to come from well beyond the speakers themselves, at the extreme sides. Thus, stereo gets its wide "spread," that complete sound-curtain from side to side that is the most useful aspect of stereo reproduction. With only two separate sound-sources before our ears, we can locate virtually an infinity of points from side to side. A fascinating illusion!

What if the channels are reversed in their phasing?

Then every identical signal in the two stereo channels moves the speakers out of phase. So there can be no reproduction of the intended middle ground! Though the loudness balance is unaffected, all aspects of the phasing are reversed; one factor now disagrees senselessly with the other, the two fighting to place apparent sources in quite different locations.

And yet the effect, though false, is not necessarily unpleasant. Keep three things in mind:

1 A good listening room always blurs the two sound-channels together to some extent via its liveness, its reflections. This is as it should be. We sacrifice some side-to-side clarity (and add more in the recording, to compensate) in favor of a well-rounded room sound.

Even out-of-phase, this room sound reaches us as it should and we still enjoy its effect on the music.

2 A major part of the stereo effect is due simply to sounds that appear more strongly in one speaker than the other. Often they are entirely in one speaker, as in much "popular" stereo recording (the so-called "ping-pong" effect). Phase reversal does not noticeably affect those sounds which are all on one side. Those which are louder on one side than the other, and thus with proper phasing appear to one side and between the speakers, tend merely to shift position, sounding on the same side but beyond the speakers when phase is reversed. This "wider separation" is often acceptable to the listener (though experienced stereo listeners learn to mistrust it).

3 And finally, we must not discount the ear's amazing ability to make rights out of wrongs, to overlook contradictions and distractions when good things are to be heard.

Correctly phased speakers always produce a smoother, more harmonious sound and a truer re-creation of the recording, in the long run making for more relaxed and more perceptive listening. And so common sense dictates that you check your speakers for phasing even if you can't tell the difference—or think you can't—as the music plays. There is a difference, definitely.

If you find the phasing test on Band 2 confusing, you may prefer the alternate phase test on the last band of Side A, Test 5, which presents two long, steady test tones, ten seconds each, the first in phase, the second out.

Test 3
Side A, Band 3 BALANCE ADJUSTMENT

This test serves to balance your system's two channels very exactly for equal loudness, in preparation for the loudness comparisons to be made in Test 4. It is in effect a sharpening of the right-left comparisons of Test 1. In place of the low-pitched tones, right and left, Test 3 presents a higher test sound, the "pilot" tone that will serve as a reference standard in Test 4. It is presented in three instead of two positions—left, right and center; the sequence is repeated a number of times.

The "pilot" tone heard here is also a third-octave band of "pink noise," centered at 1000 cycles. In musical terms this places it just below high C, two octaves above middle C and three octaves higher than the test band previously heard. (Play all the keys from B flat to D simultaneously at that position on the piano and you will hear the similarity to the "pilot" tone.)

Your speakers are already in phase (Test 2) and so you should be able to adjust quickly the center tone so that it seems to come from a point exactly between your speakers, with the other tones equi-distant to left and right.

Test 3 also offers an excellent means of evaluating your listening position in terms of stereo effectiveness, especially if, as is often the case, you find it necessary to sit at a point to one side of the center line between speakers.

It is well at this point to clear up a too common misconception, namely, that to experience the stereo effect, your stereo audience must be lined one behind the other down the middle of your living room, precisely on the center line between speakers! True, the ideal listening spot is directly on the mid-line (with an angle between you and the two speakers of not much less than 60 degrees, nor more than 90). But stereo, of course, can be heard effectively from other positions as well.

You may enjoy acceptable home stereo from a surprisingly varied range of locations, once your system is set to perform in optimum fashion. Many subtle aspects of good stereo sound, you will find, somehow are able to carry even around corners and through narrow doorways. This discovery is one of the pleasant surprises that await you in stereo listening.

Use Test 3, then, to assess your listening spots for their effect in stereo terms. Use the three test tones, left, right and center, as though they were three musical instruments, or three actors, spaced out on a stage. You can count on good stereo sound wherever you can distinguish all three positions as different, even though they may not be precisely balanced.

The farther you move to one side, the narrower will be the apparent angle from you to the

"stage," your speakers. Therefore, it will help to move forward, towards the nearer speaker, even though this may seem to exaggerate the sound on one side. It is not an unmusical exaggeration, you will discover.

You have one recourse denied to the concert listener in his off-center seat. If your listening spot is permanently located to one side of the center, you may adjust your balance control slightly to favor the more distant speaker, thereby shifting the entire sound-image sidewise to counteract the effect of your position. Test 3 allows you to make this adjustment with accuracy, placing the three tones in the best possible relationship as you hear them. Needless to say, you will not force the point. Your stereo can be "stretched" quite a good deal, but not beyond reason.

Test 4
Side A, Band 4 STEREO FREQUENCY RESPONSE ADJUSTMENT AND CHANNEL ISOLATION

This is the most interesting test on the record, for it enables you to adjust your phonograph equipment to the acoustics of the room itself, as well as to your own ears. The method is by loudness comparison between the "pilot" test tone repeated and a wide range of comparison-tones at frequencies from the very highest to the lowest recorded sound. Because it is highly subjective, you should not expect to play this test through merely once. It is a subtle test, and by the same token it can be "learned" for more and more meaningful results as your ears come to understand its significance.

The goal of recording for home entertainment is to present an imaginative re-creation of the original performance before the microphones in terms of home listening. It is not by any means enough (as most people assume) merely to reproduce sound "flat," faithful to the original at the speakers. We must include the room itself, not to mention the ears (and minds) that listen.

But how are we to do this? Mostly, we adjust our systems hit-or-miss, by sheer guesswork or intuition, or we take them as they are, for better or worse. Luck favors plenty of us; intuition helps others. But, even so, how few listeners have had enough experience within many listening rooms, to know how their own listening situation ranks comparatively against an ideal!

The ideal is accurately embodied within the long series of strange-sounding test tones that constitute Test 4. These sounds are not musical, nor are they pleasant. They are designed, after long study of the psycho-acoustic research in the field, to make it possible for you to tell exactly where your system deviates from the ideal in terms of the sound you actually hear. You have tone controls to match your equipment to your listening. But beyond this you may make further corrections—in the equipment itself, in the placement and quality of the furnishings in your room, in the

location of your listening spot—which will bring the reproduction still closer to the measurable ideal.

The test is simple in principle. Each test tone, in a long series ranging in frequency from a high of 16,000 cycles all the way down to 30 cycles in the lowest bass, is compared directly to the 1,000 cps "pink noise" "pilot" tone which has been adjusted in volume throughout the series to match the known loudness-perceptions of the ear. If each tone in the series appears to you neither louder nor softer than the "pilot" tone, you are hearing the sound at that frequency according to the standard incorporated in the record itself—as the recording director intended you to hear it.

The ideal, of course, is more or less superhuman. Even the recording director is a mere mortal, though his ears and his musicianship are often superior. In practice, our listening situation is excellent if it balances a reasonable proportion of these ideal test tones for an equal loudness with the "pilot" tone, particularly through the middle ranges of the series. Many loudspeakers will reproduce neither the very lowest nor the very highest tones in the series, though their tonal range is still quite adequate for musical listening.

Similarly, many ears cannot hear the highest of the test tones. (None of us can make much of the very lowest, beyond a sort of rumble or shake.) For most adults the first test tone at 16,000 cycles will be inaudible, and many will hear nothing above 10,000. That still is plenty for good music listening.

Test 4 is designed for stereo systems and presents its tones first in the left speaker, six times, then in the right, six times. Test 6 (Side B, Band 1) is a monophonic equivalent, each test tone played six times only, instead of twelve. The two tests share all tonal and frequency characteristics. Therefore, if you are not concerned with speaker or channel differences, you may use Test 6 which takes only half the time needed to play through Test 4.

If your loudspeakers are "twins" of the same make and model, you may safely assume that their sound is identical. On the other hand, remember that room location has a crucial influence on speaker sound, and thus two identical speakers may sound quite unlike as you listen to them. Therefore, they will give you quite different results via the test tones. This is exactly what you need to know.

A speaker in an alcove sounds louder than one placed in a large room. A loudspeaker in a corner, placed against the floor, will project noticeably more bass, as well as appear to be much louder than its twin placed, perhaps, on top of a room divider. Other more subtle reflections can play havoc with the smooth response of the finest speaker. All these things may be assessed via the test on this record.

If your speakers are unlike, of different makes or types, you will need to pay very close attention to their individual sounds—your main concern may be to make them sound as much alike as possible via individual adjustment according to the test tones.

Test 4 (and Test 6) should be used for exploratory experiments over a considerable period before you make any ultimate decisions. Loudness evaluation is subjective, the tones merely sound different, and unrelated to the "pilot" tone. The following procedure is suggested, to allow you to accustom yourself to these loudness values while gradually making more precise measurements of your own listening:

1 First, play the entire series through. Notice which of the highest comparison tones is the first to become audible to you—16,000, 12,000, 10,000 or 8,000. At the low end, watch for a point at which the loudspeakers begin to weaken on the low notes and fade away to nothing. You will want to discount these two end areas in your final evaluations. A few listeners who have excellent ears and superb sound systems will be able to make use of all the test tones at both ends of the series. Most may safely evaluate the bulk of them, say from 8,000 down to 150 or 100 cycles.

2 On a subsequent playing, begin to make definite evaluations for each of the tones within the acceptable area. Begin with the tone below the highest that you can hear with volume set at moderate loudness; stop with the tone above (just before) the first in which the bass begins to disappear. (Remember that in normal hearing loudness falls off drastically at both extremes. None of the very high or very low tones will seem loud to you. A quicker plunge towards actual silence marks the practical test limit in the bass.)

3 Begin to experiment with actual corrections. You have three main avenues for these—first, the amplifier tone controls and/or the balance controls found on many loudspeakers; second, changes in your listening spot, in speaker location and, further, in room furnishings and arrangement, chairs, sofas, hangings, rugs, drapes, carpeting; third (and least likely), changes in your equipment itself if it proves to be faulty, or if it allows less flexibility in adjustment than you feel you need.

The first thing to do is to evaluate your tone controls to find out what they can do for you. Run through the test tones, at each one swinging the appropriate HIGH or LOW tone control all the way from maximum to minimum as the tones are repeated. By the sixth playing you will have "zeroed in" on a proper loudness balance, and you will then jot down the position of the control for that frequency. Note that amplifier tone controls are most effective at the extremes and progressively less so towards the middle frequencies. The 1,000-cycle "pilot" is hardly affected at all by them if your equipment is well designed.

If you wish to try the useful but more limited loudspeaker balance controls, follow a similar procedure—remembering that each speaker must be adjusted separately. An accomplice is a good idea at this point, and you may have to run tests on each speaker alone. (Use the more rapid Test 6 on Side B.) Speaker con-

trols vary; some are volume controls on tweeters and mid-range units, increasing or decreasing the entire output of a section of the loudspeaker system. Others provide merely a two-position or three-position switch with normal increase and decrease of the high tones. Since the bass is seldom adjustable on loudspeakers, you will deal only with the first half of the test.

4 Now for "averaging out." You may have found that a number of test tones show up markedly different imbalances. You cannot correct each one. Instead, you must make a judicious average tone-correction, lumping the difference you have uncovered, setting the tone controls at a mean point.

5 Proceed, if necessary, to your room itself. If you understand that even small differences in speaker location can cause very large apparent differences in the sound, if you know that each bit of added deadening material in a room reduces stridency of higher tones, and vice versa in overly plush and draped rooms, then you will find much to occupy you between further tests.

Test 4 is also valuable as a check on your phonograph pickup's ability to keep the two sound-channels separate at all frequencies. If all the test tones appear to originate uniformly at the speakers, to left or right, the channel separation is satisfactory for good stereo. If they appear to come from between the speakers, or if they wander, your equipment provides faulty separation, i.e., it is mixing the two recorded signals together. This trouble is usually in the pickup cartridge, though you may have accidentally turned the blend or "separation" control on your amplifier. (See also the final paragraph under Test 1.)

Because some elements in your equipment are subject to change, notably the balance of channels in some types of magnetic pickup, it is wise to go over Test 4 again from time to time. You may consider this a kind of maintenance routine.

Test 5
Side A, Band 5 STEADY-TONE PHASE TEST

As explained under Test 2 above, this alternative phasing test dispenses with the rapidly alternating tones of Test 2 in favor of a pair of long (ten-second) tones, the first in phase, the second out of phase. Some listeners will find this test easier to use. (But Test 4 should be gone over first for best results.) This test uses a wide band of "pink noise"—the loud hissing roar heard at the beginning of this record side.

As in Test 2, the in-phase "pink noise" will appear to come from between the two speakers, and will sound solid and heavy. The out-of-phase band will seem to be less solid with less bass, will seem a trace less loud, and will not be as easy to center between speakers—it is likely to be heard off to the sides. Again—all of this is subjective; listen and look for your own clues. The in-phase sound (the first) is easily the more "relaxed" of the two; the

out-of-phase is subtly restless and unpleasant. If the sequence of the two is reversed, your speakers are out of phase and the connections to one of them should be reversed.

Both this test and Test 2 may be used as rough indicators of listening room liveness. If you cannot hear the phase differences unless you are very close to the loudspeakers, your room is too live for good stereo listening. If the phase differences are immediately noticeable in all parts of the room, even at a distance, your listening room may be too dead for best stereo.

Test 6
Side B, Band 1 MONOPHONIC FREQUENCY RESPONSE ADJUSTMENT

This is the monophonic equivalent of Test 4, presenting exactly the same sequence of "pink noise" test tones against the same "pilot" tone for loudness comparisons at a series of frequencies ranging from very high to very low pitch. But here the test tones are presented only six times, instead of twelve as in Test 4 (six to the left and six to the right), and the test is thus half as long.

For those who own monophonic (non-stereo) reproducing equipment, this test replaces the stereo Test 4, and all comments made under Test 4 apply, except, of course, those having to do with stereo channel differences. Needless to say, the effect of the listening room on monophonic reproduced sound is just as important as it is in stereo listening. The adjustments possible via this test series are for the monophonic user precisely comparable to those of Test 4 for stereo.

Stereo users may play this test instead of Test 4 for convenience when channel differences are not involved. Saves time. Your two speakers here receive an identical "mono" signal, recorded with equal intensity and in phase. All tones, therefore, should appear to come from the center point. You may thus use Test 4 as a more precise balance test, for further adjustments of channel balance (see Test 1).

It is quite possible that you will find inconsistencies in this balance. Some of the tones may still appear "off-side," to right or left, though the majority are located at the proper mid-point. If so, you know that there are still imbalances of some kind in your listening room sound. They may be in your equipment, or they may be a product of the room itself—but the "pink noise" test tones are deliberately designed to minimize sharp room reflections; their smooth mixtures of many neighboring frequencies tend to "average them out."

Therefore, a persistent imbalance at one or more frequencies, a sidewise shift of the image in this test, is likely to be a product of your equipment rather than of the room. (If so, it will persist, even when you move your listening spot.)

Test 7
Side B, Band 2
HIGH-LEVEL GLIDE TONE TEST

A glide tone is a siren-like pure synthetic tone (not a "pink noise" band) which moves continuously through many frequencies. The glide tone in this test is recorded at a high level, the maximum for normal recording purposes, and descends slowly from the very highest frequencies (above the hearing range of many ears) down into the low bass. You may use it with stereo or monaural equipment. Marker "beeps" are heard at 15,000 cps (the beginning), 10,000, 5,000, 2,000, 1,000, 500, 200, 100 and 50 cps. Count them off as you listen.

Unlike the earlier "pink noise" test sounds, this test is deliberately designed to pick out sharp tonal resonances, "peaks" of sudden loudness at critical frequencies. Where the third octave "pink noise" bands have smoothed out and blurred these sharp resonances via their blending of many contiguous frequencies, the pure tone of the glide test shows up every tiny irregularity. The results are likely to be startling. They will give you a further precise indication of the profound influence your listening room has upon sound reproduced within it.

As the glide tone plays, sit in your usual listening position and do not move your head. (You will begin to hear it at your own individual hearing "threshold," perhaps well below 15,000 cps.) You will experience a surprising succession of almost piercing loud and soft effects as the siren-tone descends, somewhat like the irregularities of sounds heard outdoors on a windy day. Moreover, there may be almost painfully sharp differences between your two ears, the sound seeming to jump from side to side with sudden pressure in one ear or the other.

These startling inequalities are not on the record, but mostly are caused by the listening room.

You may prove this easily by making changes in your listening situation. Move your head from side to side, or move about, and you will find that the pattern of loudness "peaks" is immediately altered. Marked loud spots in one position may virtually disappear in another.

An important use of the glide tone is to uncover the source of annoying rattles and buzzes of the kind that often punctuate otherwise pleasing sound reproduction in the home living room. Some of these are in the electrical signal itself. Most, however, are out in the room—external vibrations in various loose objects, from cupboards to loose window panes

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to loose pencils or coins. It is often hard to locate these since they respond sympathetically only to a narrow range of frequencies, which occur in music entirely at random. The glide tone will set off these vibrations systematically, one by one, as their response frequencies are touched. When you hear a buzz or rattle, quickly repeat that portion of the

glide tone until the source has been found in the room.

Standing waves—violent sound-peaks due to reflections between flat parallel surfaces—occur at fixed points and may be inaudible only a few inches away, or may appear to jump from one place to the other. With the glide tone you can spot these in your room and check after measures have been taken to damp them out via sound-deadening material.

Tests 8 and 9
Side B, Bands 3 and 4
LATERAL AND VERTICAL TRACKING TESTS

Tests 8 and 9 are concerned with the tracking ability of your pickup stylus, stereo or mono, and may be used to give you accurate reproduction of the record groove. In both test bands you will find a series of tones, each at a higher level than the one before. Performance of your pickup can be judged directly by the sound, which becomes noticeably distorted when the stylus is unable to trace the grooves correctly.

The record groove itself can cope with a wide dynamic range of recorded sound—it has considerable "reserve" capacity, even beyond the normal maximum level. Your pickup, similarly, should be able to trace recorded vibrations at a level well above the average. The tests will tell you exactly how well it is behaving, with respect to the lateral motions common both to stereo and monophonic ("high fidelity") records (Test 8) and in respect to the vertical motions that are essential in stereo and are significant, though to a lesser degree, in the reproduction of mono records (Test 9).

Generally speaking, the more compliant a stylus is—that is, the more easily it bends—the better it can trace complex grooves at high recorded levels. Other factors are: the mass of the pickup arm and its resonance point, the correctness of its swing, keeping the stylus lined up with the groove and, most important of all, the stylus force, which today is measured in grams.

Because the modern pickup seems featherlight to us, we are apt to assume that a bit of extra "weight" on the point can't do any harm. Many people casually pile dimes and nickels on the pickup to force it into tracking. The fact is that the tiny, half-round ball-point of the stylus jewel, with mere feather-like force from above it, exerts a pressure on the V-shaped groove walls measured in tons per square inch. The smaller the "point," the greater the pressure.

To prevent serious groove damage the stylus force must be held to the very lowest figure possible. Yet, too little weight above the stylus allows it to jump loosely about in the groove, causing distortion in the sound and rapid wear of the record. To find how much is neither too little nor too much is thus of great importance. The manufacturer of your cartridge gives stylus force recommendations which are usually followed by dealers who install equipment; if you have mounted your own pickup in its arm, you will have met this problem directly your-

self. Tests 8 and 9 do not measure stylus force —they simply indicate performance. If you have any doubts at all, you would be wise to check your stylus force immediately, before using the test grooves.

If you do not have a stylus gauge (many types are on the market), you may improvise one out of a small piece of wood or plastic used as a balance beam centrally placed over a pencil (preferably without the flat, hexagonal sides), plus a few small coins. A tongue depressor, available at any drugstore, is ideal; a wooden plant marker will do as well. Mark a slight dent or groove at one end to hold the stylus point, and lay across the pencil on the turntable, on a line from the stylus to the center spindle. Lower the stylus carefully onto the dent or groove, and then put coins on the other end until the pickup just balances at the proper force as indicated in the coin-scale on page 16. The weight of the coins indicates your stylus force. It should not be greater than the maximum figures to follow and should be lower if the Test Bands indicate adequate tracking. If you cannot get proper results, even with the maximum allowable stylus force, a review of your equipment is in order. Note that a badly worn stylus will cause distortion in all the test bands.

The standard monophonic (non-stereo) stylus has a point radius of only a thousandth of an inch (1 mil). The better mono cartridges should track properly at as low as 3 to 5 grams when mounted in good quality arms. Cartridges for record changers use generally less compliant styli and require slightly higher force—but 8 grams is a safe maximum.

Because the standard stereo stylus has an even smaller rounded tip (.7 mil), the stylus force must be even less. No stereo pickup should be used with more than 7 or 8 grams measured at the stylus; most will track the test tones adequately with from 3 to 6 grams.

Test 8, the lateral test, provides five steps ranging from the normal average level of many recordings (0 db) up to a tone recorded 12 db up, or sixteen times as intense in sheer sound-power when reproduced by your loudspeakers. Any pickup, even of modest quality, should with proper stylus force adjustment play at least the first three successively heavier test grooves without audible distortion. Really good equipment, mono or stereo, should reproduce all five test tones without distortion.

Proper tracking produces a smooth, hollow, pure tone without overtone coloration. Mistracking results in a sharper, brighter sound that quickly turns into a buzz—the familiar "bad needle" sound. When tracking is faithful, the tones will sound exactly the same, except that each is louder than the preceding one.

Test 9, the vertical tracking test, provides seven steps for a more exact assessment both of mono and stereo pickups. The tones range from well below to well above normal average recorded level. The test results will be quite different for stereo and mono pick-

ups, since the pickup requires only a slight vertical flexibility to track monophonic discs, whereas the stereo pickup must track rather large vertically recorded signals without distortion.

A good quality mono pickup should play the first two vertical test tones and perhaps the third without undue distortion. (The sound will be faint, but you will hear any distortion that occurs.)

If your mono pickup happens to be vertically flexible enough to play the first four vertical test cuts without distortion (again, the sound will be faint), then you may safely play all stereo records as well as mono, all of which will be reproduced in monophonic sound. If not—then DO NOT PLAY STEREO GROOVES! Do not play Side A of this record.

A modest stereo pickup should track at least the first five vertical test tones with no significant distortion. A good stereo pickup will track through the sixth without trouble and many top-grade pickups should track all seven tones but a trace of buzz in the seventh tone should not be cause for serious worry.

Coin Scale

Penny	—3 grams
Nickel	—4¾ grams
Dime	—2¼ grams
Quarter	—5¼ grams

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