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Royer Labs R-121

A new ribbon mic ups the ante on a classic design

At last year's AES convention held in September in San Francisco, there was quite a buzz around an unassuming, phone-booth-sized enclosure in the middle of the exhibit floor. Was it the latest vacuum-tube-heated foot massager? Or perhaps a 48-bit digital workstation that records onto a wax cylinder for the ultimate vintage sound? No, the structure was a listening room for an old-fashioned idea whose time has come - again. The booth belonged to Royer Labs, and the product causing all the buzz was the company's flagship offering, the R-121 ribbon mic.

Premium Stogie

The R-121 is a simple affair, based on the classic ribbon-mic design (see the sidebar "Ribbon Mics"), but with some significant changes, including a thicker, more resilient ribbon and a neodymium rather than alnico magnet. The mic's cylindrical, satin-nickel-finished body is six inches long by one inch wide. At a distance the R-121 could be mistaken for a small-diaphragm condenser, if not for the distinctive vents and vertical fins on the upper half of its casing. The mic's two-inch-long, side-address ribbon sits flush between these magnetic fins in a detachable transducer assembly. A Switchcraft XLR connector is recessed precisely in the cylinder's bottom end, and the stylish Royer emblem indicates the mic's on-axis front position.

The R-121 is easily held on a stand with the included spring clip; the mic's slim dimensions and light weight eliminate the need for bulky mounting hardware. The size of a premium stogie, the R-121 comes in a classy wooden box that looks as though it would hold a dozen fine cigars. Optional accessories include a windscreen and shock mount. A matte-black chrome finish is also available, and you can order the mic with a 200-ohm rather than 300-ohm transformer at no extra charge. (The 200-ohm version supplies about 3 dB less output, which some people may prefer.) Royer Labs

confidently offers one free re-ribboning, as well as a lifetime warranty, to the original owner.

Fire It Up

The first test I performed on the R-121 was a ribbon-mic comparison in which I recorded music from CDs played through loudspeakers. (For the tests, I used Focusrite Green mic preamps and Monster Cable exclusively.) I consecutively set up five ribbon mics - the Altec 639b, beyerdynamic M 160, Coles 4038, RCA 44BX, and the R-121 - about 14 inches from the front of a Tannoy PBM-8 speaker. I then recorded four songs to DAT and transferred the proceedings to a computer for evaluation.

As for self-noise, the Coles mic was quietest, followed closely by the Royer, and then the beyerdynamic. The R-121's clear, airy highs reproduced the music with the greatest fidelity, although here and throughout the testing period the mic seemed slightly prominent in the upper midrange (1 to 3 kHz) and a bit brash as compared with the Coles (which exhibited a low-end emphasis).

Among the other three mics, there was really no contender. Although each can be magical for certain recording applications, none exhibited a sufficiently flat frequency response to warrant comment here.

The frequency-response charts for the Coles and Royer models revealed no dramatic differences between the two. Both graphs track a flat response curve from 40 to 15,000 Hz (± 2 dB), with the R-121 extending impressively up to 18 kHz (well beyond Royer's conservative specs). Output gain was equivalent for the two mics, both of which have classic bi-directional (figure-8) polar patterns.

The R-121 will probably evoke many comparisons with the Coles 4038 because the Royer mic is the newcomer in this limited field and is the 4038's closest competitor in both sound and price among available ribbon mics. The Coles 4038 is one of my ten favorite microphones, and it served as a useful reference for many of the sonic comparisons in this article.

Compared to What

Royer Labs supplied a matched pair of R-121s, so I also compared the mics with each other (as distant room mics on a drum kit) and found that they sounded identical to each other. Obtaining this level of consistency is notoriously difficult with condenser

mics. But the structural simplicity of ribbon transducers (which have fewer electronic parts and a more basic mechanical system) evidently makes uniformity easier to achieve.

I also compared an assortment of dynamic and condenser mics with the R-121. On a blues-guitar track, the ribbon mic preserved the vital cutting power of a Danelectro guitar and Fender amp pairing, and sounded more intimate and less metallic than either of the dynamic mics I typically use in this application. Combining accurate transient response, subtle detail, and hard-hitting upper-bass frequencies (250 to 400 Hz), the R-121 had more impact and realism.

A

premium, large-diaphragm, cardioid condenser mic was surprisingly close to the R-121 in its frequency response, but in the end, none of the mics I auditioned delivered the same pick sound and level of nuance that give the R-121 its wonderful "you are there" quality.

Upon first listen to the test recording of an Epiphone hollow-body guitar (played through the same Fender amp with the R-121 positioned nine inches back from the grille cloth), I was left momentarily breathless. Here were all the full lows, rich mids, and fingers-on-the-strings sensuality that you expect to hear in live situations, coming right off the DAT with astounding realism. For this job, the other mics just couldn't compete: the dynamic mics sounded thin; the other ribbons were too bottom heavy; and the large-diaphragm condenser, though a close second, didn't provide the R-121's depth, dynamics, and clarity.

Toss-Ups

On percussion, choosing among the R-121's sound and three of my favorite condenser microphones was a toss-up. The R-121 gave a more pure tone during the decay of a small cymbal, and in general sounded more sensitive and a little less fuzzy. But it also made the sound of the cymbal strike a bit too dark.

On a dumbek, the R-121 provided less power and sustain on the low dum tone and less high-end detail on the bek than the condensers. But again, it was a toss-up: depending on the accompanying tracks, an engineer might prefer the softer, more organic tone of the R-121 over the brighter, more distinct sound of a condenser mic. Of

course, mic positioning and room tone (the room in this case was fairly dry and lifeless) are critical when it comes to miking such a complex instrument - especially with a figure-8 pattern mic, which is more susceptible to rear reflections and off-axis coloration than the average cardioid condenser mic.

On acoustic guitar, miked mono, the R-121 had its moments, but it wasn't always a clear winner. On rapidly strummed rhythm parts, for example, it was too dark and mushy sounding to be useful. On the lazy, arpeggiated chords of a jazz improvisation, however, the R-121 again demonstrated its impressive honesty, rendering a clear, balanced representation of frequencies and rivaling the clarity of the condenser mics.

Two of a Kind

I like the increase in depth and presence that stereo-miking offers and have often deployed matched pairs of mics for live recordings, vocals, and acoustic instruments in multitrack mixes. So it was with great interest that I put up twin R-121s alongside two tried-and-true pairs of condenser microphones.

At first listen, the stereo recordings of a wood block sounded similar, but upon repeated auditions, I noticed that the R-121 tracks were easier on the ears, were more dimensional, and sounded more true-to-life. In comparison, the condenser tracks sounded slightly harsh and flat, and they exhibited a veiled fuzziness that made the wood block sound vaguely electronic.

Next, I recorded the dumbek again. This time, though, to test the mics' off-axis response, I used a live room and positioned the drum about six feet behind the mic cluster. Here, the drum sounded great, thanks to the R-121s' crossed figure-8 patterns and full midrange response. However, a tambourine (in front of the mics) was too thick in the low end and dull in the highs as compared with the condenser pairs.

On the acoustic guitar, beating the bright sound of the stereo condenser pairs on a busy strummed rhythm was predictably hard. But on a classical guitar piece, my decision was split: I wanted to hear something midway between the crisp condenser tone and the slightly muted but beautifully "woody" ribbon sound. (With a little EQ and optimal mic positioning, the R-121 could really shine on this instrument.)

I also had the guitarist play and sing simultaneously for this same double-XY configuration, and one of the cardioid condenser pairs gave a very pleasing balance of

voice and guitar that the R-121s were unable to match. With the R-121s, the soft, female voice sounded more distant and off-axis than I would have expected. A glance at the mic's polar-pattern response chart provided a likely explanation: the performer's voice was about 45 degrees off-axis, and with these mics, a flat frequency response is possible only within 30 degrees left and right of the center of the ribbon. This tight patterning also helps account for the difficulties I had in my next test - using the R-121s on a drum kit.

Overhead Hankering

I've always wanted to try using ribbon mics as drum overheads, and the matched pair of R-121s gave me cause to experiment extensively with stereo placement. I miked a midsized Drum Workshop kit at a conventional distance, and also miked it as close as the drummer's stick activity would allow. I approached the kit from the front and from the back, with the mics at varying degrees and angles, with and without EQ, and yet I still was unable to capture a sound that had the tonal balance, high-end zip, and tightly focused imaging and ambiance of the condenser-mic pair I routinely use.

I achieved the most suitable tone by miking the kit as close as possible from in front and above, then using wideband equalization (-2 dB at 600 and 900 Hz) to counteract the abundant midrange produced by the R-121s' proximity to the toms and cymbals. Combined with a 3 dB high frequency shelving boost, this arrangement eventually yielded a tight, saturated sound with lots of punch on the toms and increased definition and clarity for the five cymbals.

Listening to the playback, drummer Karen Stackpole commented that the sound of the equalized tracks was much fuller than that obtained with the condenser pair (unequalized), which sounded washed out and thin by comparison. And yet the R-121s' high end still lacked in crispness above 8 kHz, and the more remote cymbals were under-represented in the stereo spectrum due to the inherent off-axis attenuation of the R-121s' figure-8 patterns.

Moving the mics higher up from the floor would, in theory, make the sound field wider and more inclusive. But in fact, the highs suffered and the room sound quickly became overpowering as the miking distance was increased. I could imagine the R-121s working much better with a more compact jazz kit, or on a cymbal-bashing rocker, or in a drier acoustical space.

Handle This

Miking a kick drum isn't a stunt I'd try with my vintage RCA 44BX; older ribbon mics have a reputation for being easily damaged by loud, plosive sounds. But John Jennings, sales manager at Royer Labs, assured me that two notorious engineers - Sean Beavan and Fletcher - both failed in their attempts to send these mics to ribbon heaven, so it seemed worth the risk.

Positioned at a conservative distance (nine inches) from the double-headed kick drum, the R-121 did indeed hold up beneath the volley of arena-rock thunder. And although it didn't give me enough attack for the rock part that was going to tape, the R-121 track, when compared with tracks recorded the same way by two different large-diaphragm condenser mics, exhibited the best low-end extension and least snare/hi-hat leakage.

Farrago

During various commercial studio sessions, the R-121 also proved worthy on clarinet, trumpet, violin, and distant-miked percussion. It also confirmed its unique ability to capture deliciously thick, yet well-defined, electric-guitar tones. On close-miked acoustic bass, the R-121 held its own against the Coles 4038 and even provided outstanding results as far back as four feet from the instrument - a distance at which the 4038 began to sound diffuse and dull. Smokin'!

Throughout the test period, the R-121's performance impressed me as well as refreshed my long-standing appreciation of ribbon technology. In general, this microphone matches the smooth response and rich midrange characteristics of vintage ribbon mics (and many tube mics), and it often surpassed other microphones in my collection, thanks to its upper-midrange realism, crisp high-end definition, and superior reproduction of ambient or distant sources.

When positioned too close to a source (and on certain dense, loud, or full-frequency percussive sources), the R-121 often exhibits an exaggerated proximity effect and loss of high-end sensitivity. However, this "clouding" can be reduced in most cases by moving the mic back a few inches, as long as a corresponding increase in room sound is acceptable. On the other hand, it is a tremendous advantage to have a ribbon model that can safely be placed close to bass drums, loud amps, and other sources that have been traditionally regarded as off-limits to ribbon mics.

Whether as an introduction to the soothing sounds of ribbon transducers or as an addition to an established mic cabinet, the Royer R-121 gets my heartiest

recommendation. And in case you're wondering whether this mic has what it takes to please a hard-core mic fanatic, I can assure you that at least one Royer Labs R-121 will find a home in my cabinet.

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Royer Labs R-121 ribbon microphone: \$995

PROS: Flat frequency response. Low self-noise. Clearer, more extended highs than other ribbon mics. Excellent realism, detail, and clarity on electric guitar and certain percussion sources. Consistent stereo-pair matching. High SPL handling. Small, light, easy to set up and position. Attractive, high-quality wood case. Lifetime warranty and one free re-ribboning.

CONS: Exhibits limitations common to most ribbon mics, such as low output and decreased high-end response (as compared with condenser mics), as well as significant off-axis attenuation. Exaggerated proximity effect on some close-miked sources. (Side Bar)

Ribbon Mics

The ribbon or "velocity" microphone was developed by RCA engineers during the late 1920s, and its basic design principles endure to the present day in the Royer Labs R-121 microphone, among others. RCA's first production models dated from the early 1930s and include the 44A broadcast model, PB 17 soundstage microphone, and 30A lapel mic. Offering dramatic sonic advantages over the carbon microphones and experimental condenser units that preceded it, the ribbon transducer concept was simple and elegant.

RCA's classic design implements a light, extremely thin corrugated aluminum-foil strip that is secured at both ends and suspended vertically between the two poles of a large magnet. The pressure-gradient ribbon responds to the velocity of air particles (rather

than sound pressure), and its movement within the strong magnetic flux field generates a small AC voltage. This signal is sent to a step-up transformer within the microphone body, which raises the output voltage and also increases the output impedance to a value (typically 150 to 300 ohms) that is optimal for input to a microphone preamplifier.

Because of the mechanical characteristics of the suspended ribbon, sounds that originate at the front or back of the microphone are reproduced evenly over the entire audible frequency range, while sounds that arrive at the sides of the mic - which produce no pressure on the ribbon - are rejected. This polar response is known as a bi-directional or figure-8 pattern and is characteristic of classic ribbon mics. In 1933, RCA introduced the 77A, a cardioid-pattern, dual-ribbon mic, and toward the end of the decade, Western Electric introduced the 639, a unidirectional ribbon/ dynamic hybrid.

Spurred on by the movie and broadcasting boom of the 1930s, a number of smaller American companies (including Electro-Voice and Shure Brothers) began producing microphones, and most of them had ribbon models in their catalogs throughout the '40s, '50s, and even into the '60s. A roster of long-forgotten microphone manufacturers vividly recalls the United States' glory years of industrialism, including such grand names as Altec, American, Amperite, Bell, Bruno, Carrier, Eastern Sound, Lifetime, and Universal.

Overseas ribbon-mic manufacturers included Aiwa, beyerdynamic, Coles, Lomo, Marconi, MB, Oktava, Reslo, Peerless, STC, Toshiba, and Bang & Olufsen (B&O), whose space-age silver-finned ribbon was the inspiration for the design of the new Royer R-121. The German titans AKG, Neumann, and Sennheiser never marketed ribbon mics, choosing instead to concentrate on dynamic models (which were more rugged than ribbons) and high-output condenser mics. Their technological innovations, resulting in outstanding and versatile microphones such as the Neumann U 47 and M 49, signaled the end of the ribbon mic's golden age.

A few ribbon mics have persevered in the marketplace, and ribbons have even gained renewed popularity among a new generation of digital recordists. Notable among currently available models is the venerable Coles 4038, which has remained in production unchanged (except for a transfer of ownership) since the mid-1950s. This model is listed in the Beatles' recording logs as an overhead mic, was used by Pink Floyd, and has often been championed by engineer Steve Albini.

My experience recording with the Coles 4038 has been that it offers a pronounced and rounded low-end response and can help soften unpleasant upper mids and highs, making it an ideal choice for using on string instruments, electric guitar, organ-and-Leslie-cabinet combinations, jazz guitar, and woodwinds, any of which can sometimes sound "scratchy" when recorded with large-diaphragm condenser mics.

Other contemporary ribbon mics include the short-ribbon beyerdynamic M 160, M 260, and M 500 models; a Fostex printed ribbon; the Speiden stereo mic (now made by Royer Labs); and the new Audio Engineering Associates AEA R44C (see Fig. A), which is a replica of the vintage RCA 44B using genuine RCA ribbon material. Oktava is reportedly working on a Russian ribbon reissue, and with the audio market being driven by vintage aesthetics, it wouldn't surprise me if other major manufacturers were reconsidering ribbon designs, as well.

Despite these signs of a comeback, it is unlikely that ribbon transducers will ever dominate the industry as they did back in the '30s and '40s. On quiet sounds and sources that may benefit from a high-end presence boost (such as pop vocals and drums), condenser mics offer a clear advantage. Figure-8 ribbon designs can also be a liability when miking large ensembles or when seeking isolation in studio recording environments. But when used creatively, bi-directional ribbon mics can yield wonderful room ambiance, as well as blends of direct and reflected sound, that cardioid patterns cannot. And nothing's quite as sweet as that old-time ribbon-mic sound for rootsy blues, R&B, jazz, swing, retrorock, and certain folk-music styles, especially on acoustic bass, cello, tuba, trombone, and trumpet.