THE COMPLETE GUIDE TO MASTERING THE BASS GUITAR

The Bass Handbook

Adrian Ashton

EVERYTHING YOU NEED TO KNOW ABOUT THE ELECTRIC BASS

LEARN TO PLAY – FROM THE BASICS TO ADVANCED MUSICIANSHIP

GET TO KNOW THE HISTORY OF THE BASS AND ITS GREATEST PLAYERS

UNDERSTAND AMPS, SPEAKERS, STRINGS, PICKUPS, AND CABLES

DISCOVER HOW TO BUY A GOOD BASS AND MAINTAIN IT PROPERLY

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This book is for my special girls, whom I love dearly:
Evelyn, Sally, and Renate.

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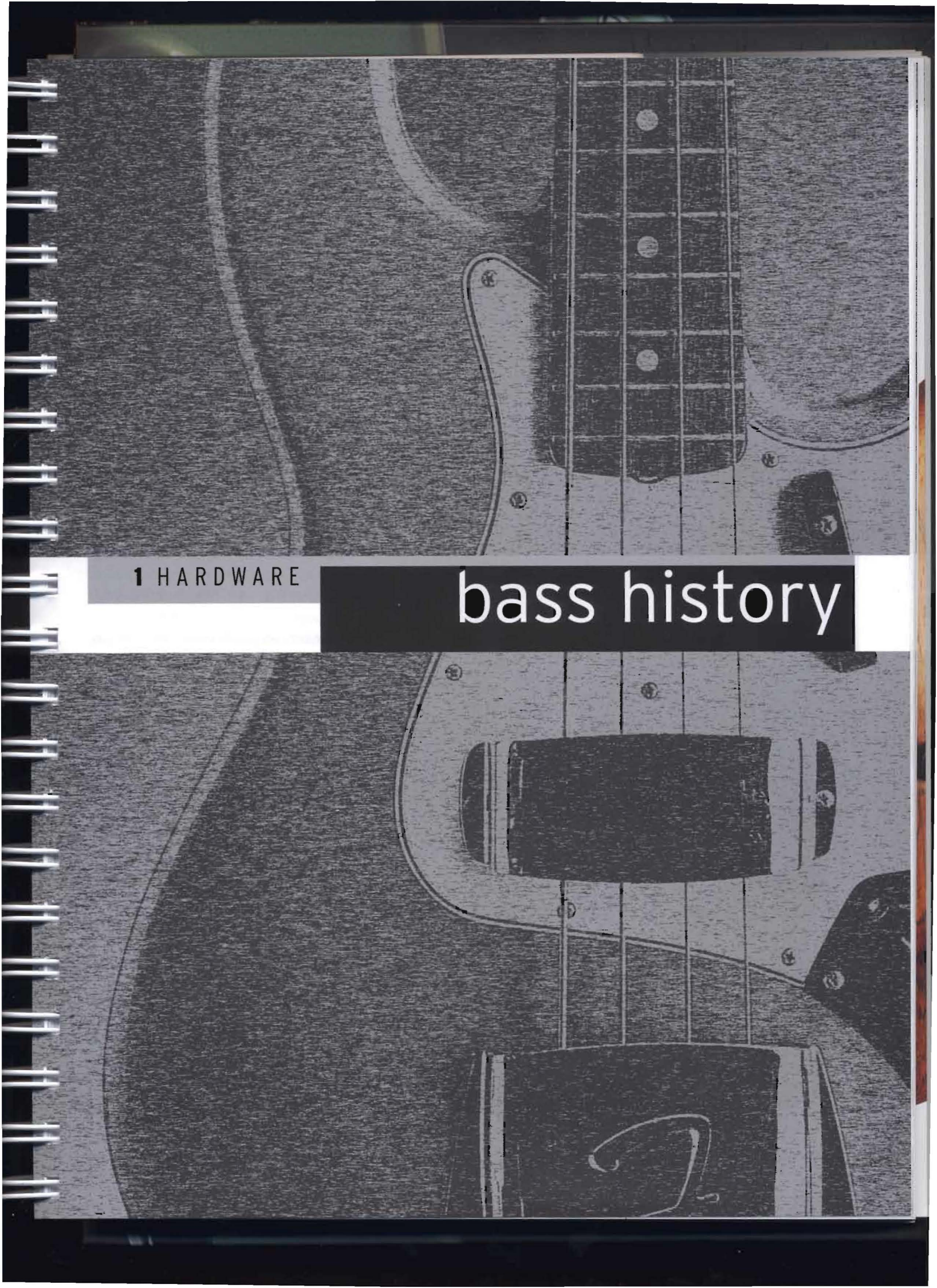
FOREWORD

Well, I've not seen this much information about *anything*, never mind the bass guitar!

Adrian's book tells you everything you could possibly want to know about instruments, amplifiers, effects, players, setups, and history. It's all here. Not to mention just plain interesting stuff that even an old hand like myself can find fascinating.

Writing with the authority and technical know-how of a player as well as an aficionado, Adrian has a dedication and obvious love of all things low frequency that makes this a book no practising or prospective bass guitarist can be without.

JOHN PAUL JONES
November 2005



1 HARDWARE

bass history

The world of the electric bass guitar; what a wonderful place to be. It means so many things to so many people, myself included. Firstly, it is, as Jethro Tull bassist Jonathan Noyce put it, "our secret weapon". Why secret? Many people forget that the bass can carry the rhythm *and* the melody, something rare amongst musical instruments. Furthermore it can influence the harmony, whether the other harmonious voices like it or not. So, like all weapons, it needs to be handled with care.

Then there's the image; electric bass is so adaptable. Bassists can be shy and retiring, using their skill and musical delicacy to drive a band forward with purpose. With a wry smile and a deep inward glow you can be crucial to the success of a musical act, and no-one else need know. Bassists like Led Zeppelin's John Paul Jones or The Who's John Entwistle spring to mind; magicians of the electric bass, they conjured up electrifying basslines but with very few stage moves. Entwistle decided to sport all-white suits just so someone would notice him on the stage alongside Pete Townshend's windmill guitar strums and Roger Daltrey's flying microphones. Bassists can be shrinking violets, whereas singers and lead guitarists can not.

But bass players can also take centre stage. Flea, for instance, is equal in stage presence to any of his fellow Chili Peppers. Virtuoso bassist Victor Wooten has been known to throw in a back-flip during breathtaking live-performance displays of fluid bass soloing. Or you can command the arena by adding some vocals to your bass work: Sting, Jack Bruce, Paul McCartney anyone?

Then there's the gear. Let's get the downside out of the way. To go really deep on the bass we need strings, instruments and amplification that tend to be a little more expensive and bulky than the gear of most other instrumentalists. This is an acceptable situation, given the advantages, and even this downside has created interesting bass-related adventures. For a start, bass players tend to have bigger ears and wider eyes when it comes to new ideas and creations. Graphite basses, neodymium speakers and extended range instruments have all been widely accepted by bassists over the years, in contrast to the "let's stick with what we know approach" adopted by others. The result is a colourful, diverse and stimulating equipment industry that caters for the wide-ranging characters in the bass community.

That's the best reason to embrace the bass guitar: the people. Many players talk about the brotherhood of bass, the sense of community and camaraderie amongst bassists. I feel it too, although we should remember that we are almost always part of a group of musicians, a larger unit with messages to deliver to our complex world. Every player I've known has taught me something, from the professionals I've learned from or interviewed to my own students. I

Leo Fender's masterpieces: a 1957 Precision Bass (left) and a Jazz Bass from 1960.

hope, in return, that *The Bass Handbook* reflects the mutual respect amongst bass players and helps to maintain the great bass tradition.

ABOUT THIS BOOK

The Bass Handbook has something to offer bass players at all levels, but it is specifically aimed at new arrivals and intermediate players. The advanced player will be able to explore the history of the bass, amplification and effects while also dipping into new areas of study, such as sight reading.

The new or intermediate bassist will find this book a pleasure to use, with its spiral-bound pages and a chapter by chapter analysis of the most important questions that are asked about the bass. As a tutor and author on the bass, I know that there are key questions students need to ask their studies. You'll find all the answers in *The Bass Handbook*.

Finally, *The Bass Handbook* makes the perfect companion for the many bass teachers out there. Students have a study method, with backing tracks, in a layout that doesn't fall off a music stand. And you can refresh your memory (secretly of course) of how to work out Ohm's Law for cabinets of unequal impedance when your student asks, "Can I connect my 4 x 10" cab to my 2 x 10"?" Just in time for next week's lesson.

Paul McCartney with his Hofner 500/1 'violin' bass.

BASS HISTORY

Leo Fender produced the first widely available bass guitar in 1951 – and got much of the design right first time. Fender, a radio repairman in California who had turned to making guitars and amps, developed the bass guitar at a time when the bassist in a band would be stuck with a large and often barely audible instrument, the double bass – what Leo called "the doghouse". He realised that bass players would welcome a louder, more portable instrument that offered precise pitching of notes.

Precision Bass

In 1951 Leo provided bassists with the aptly named Fender Precision Bass, for $195.50/£70, a sum that equates to something like $1,400/£800 now. Many of its features were based on his already successful and equally astounding solid six-string electric guitar, the Telecaster. (The Stratocaster would arrive three years later.)

Stanley Clarke with his Alembic.

The Fender Precision was an ash-bodied, maple-necked bass, its four strings tuned E A D G like those on the double bass and amplified via a simple four-pole pickup controlled by two knobs for volume and tone. In 1957, Leo restyled the Precision, making it look much as it still does today: Stratocaster-like headstock, sculpted body, and the distinctive split pickup.

Early Precision users included jazz player Monk Montgomery, of the Lionel Hampton Band, along with many country-and-westerners who constituted a large percentage of Fender's customers at the time. The Precision is of course still widely used, and the design has been much copied by other bass makers.

Jazz Bass

Fender's next bass design, the Jazz Bass, was introduced in 1960, and was distinguished by an offset body shape similar to that of its contemporary, the Jazzmaster guitar. It also differed in having a narrower string spacing at the nut and the twin pickup arrangement to give more tonal variation via three knobs – volume per pickup, and overall tone.

Gibson's basses have not done so well: the company introduced its first electric four-string, the original 'violin bass', in 1953. This design was copied by the German maker Hofner and won widespread popularity when The Beatles' Paul McCartney played a Hofner violin bass in the 1960s. Gibson's brief bass popularity came at the end of the 1960s when Jack Bruce of Cream used an EB-3, a double-cutaway twin-pickup bass. Gibson's humbucker-equipped basses sounded muddy, not helped by their short-scale necks, and they've never seemed serious contenders.

Rickenbacker basses first appeared in 1957 with the debut of their 4000 model, but achieved popularity when used by players like Paul McCartney in the late 1960s, Chris Squire of Yes in the 1970s, and later in that decade Bruce Foxton of The Jam. They are renowned for a bright sound, though this is often due as much to the player's style and amplification as to the instrument.

Active

Active circuitry offers increased tonal range by using an on-board preamp. The first bass to feature such a circuit was the semi-solid Burns TR-2, launched by British guitar maker Jim Burns in 1963 and featuring an on-board 9V battery to power an active volume, bass and treble circuit.

Later, active electronics were made more widely available, originally through the work of American company Alembic, formed in the late 1960s as a workshop to provide

technical support for the Grateful Dead's bizarre equipment requirements. The company began to produce exclusive, high-quality and expensive basses made from exotic woods and with brass fittings – some even had LEDs for position markers. Stanley Clarke was among the elite of 1970s bassists able to afford Alembic's basses, and the company was among the first to establish the idea of the specialist bass guitar maker.

Leo Fender sold Fender to CBS in 1965. His new company, Music Man, produced the still-popular StingRay bass, which did much to popularise active electronics and further enhance the reputation of Leo Fender among bassists. From 1980, until his death in 1991, he ran his own G&L company, which still makes excellent basses.

Fives, sixes and fretless

The first five-string bass was the unusual Fender V, launched in 1965 with an extra high C-string above the normal EADG, a small body, and, as it turned out, a short lifespan. In the 1980s, the modern five-string bass began to emerge, with an extra B-string below the E, primarily as the result of bassists wishing to emulate low synth bass parts. This led one British maker, Overwater, to make its C-bass in 1985; a low-tuned four-string (C F $B_{\flat}$ $E_{\flat}$).

Around 1956 Danelectro produced the first six-string electric bass guitar, the UB-2, effectively a guitar tuned an octave lower than usual. A number of session musicians popularised its sound in 1960s studios, where it was sometimes used in tandem with a string bass for what was called a 'tic tac' sound. Fender's six-string bass, the Bass VI, followed in 1962, again a 'baritone' guitar, tuned an octave lower than a standard guitar. Only a few players used it as a bass. In the 1980s six-string basses with a low B and a high C appeared. More recently there have even been seven-strings, with a high F above the C.

In 1965 the Ampeg AUB-1 became the first production fretless bass. It had a semi-solid body with f-holes cut right through it, and featured a bridge-mounted transducer so that it had no visible pickup. Fretless bass playing took off in the mid-1970s, with Jaco Pastorius remaining the bassist most clearly associated with the fretless. (See Fretless Bass, p45.)

Woodless and headless

Luthier Rick Turner and designer Geoff Gould produced the first graphite neck for a bass in 1977, and their patent was issued the following year when the two set up their Modulus Graphite company to exploit this rigid, non-warping material with its high stiffness-to-weight ratio.

In 1982 Steinberger produced the first commercial headless bass guitar, made almost entirely from graphite. It

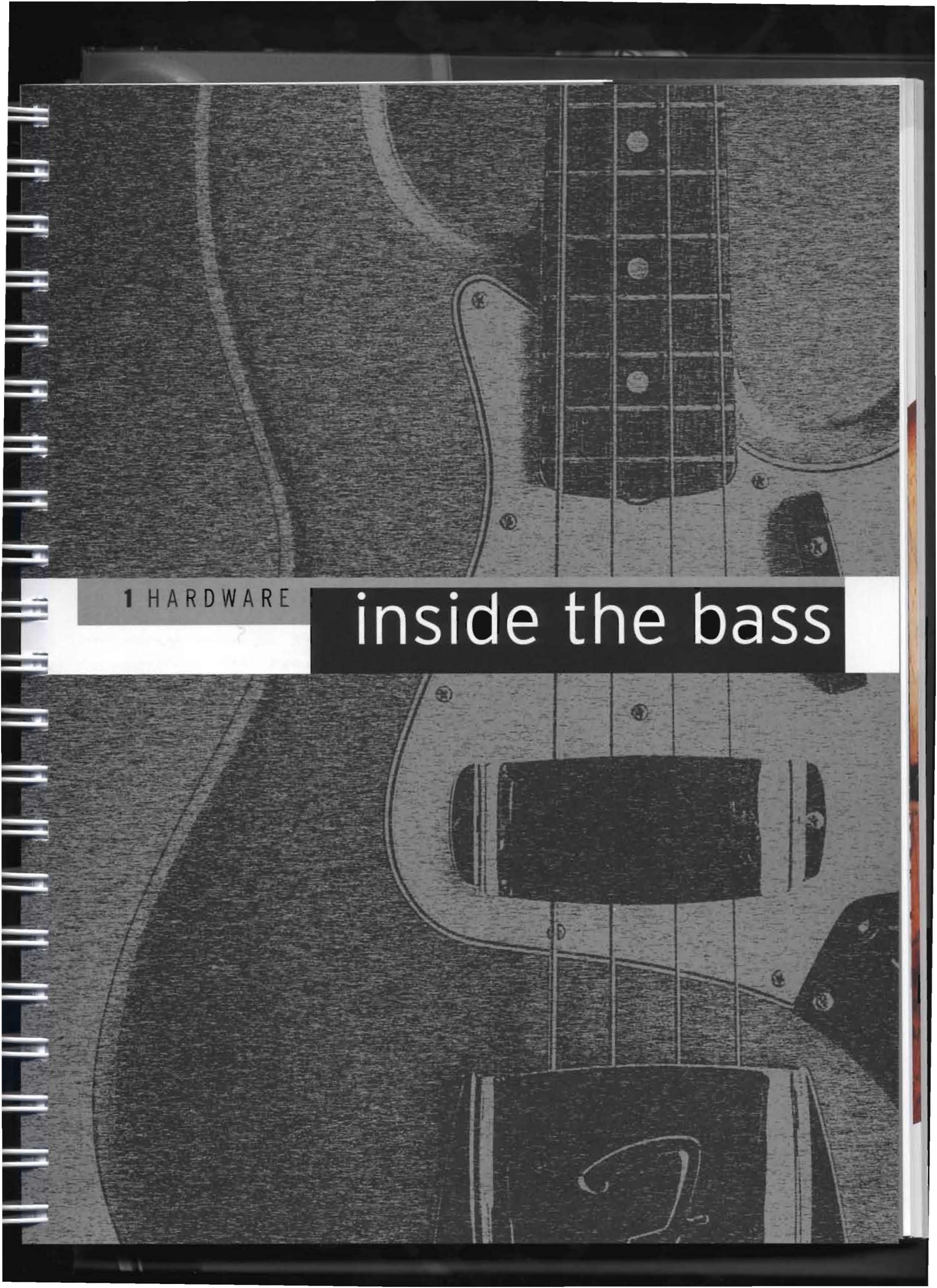
A fretless Music Man StingRay 5 (left) and Paul McCartney's left-handed Rickenbacker 4001S.

was designed to eliminate dead-spots (notes that fail to ring clearly) and to increase sustain and clarity. The first British maker to build a graphite bass was Rob Green, whose Status basses went into full production in 1983. This original Status Series II bass had a graphite core and wooden 'wings' while subsequent basses used an all-graphite construction.

Budget-priced basses from the Far East began to change players' idea of value for money in the 1980s. The budget Squier brand – Japanese-built Fender 're-issues' of vintage Precision and Jazz designs – added to the reputation of cheaper eastern-made basses. Since then budget manufacturing has shifted from Japan to Taiwan, Korea, China, India, Mexico and elsewhere.

Some bass makers have investigated the use of MIDI to help bassists play synthesised and sampled sounds from a bass guitar 'controller' – sounds that Leo Fender could never have imagined back in the 1950s. But with a retro vibe strong in the 21st century, Leo's original creations and their offshoots provide modern bass players with the tools they need to continue to make great music.

Three radical basses. LEFT TO RIGHT: the Modulus 6, the Status Series II, and Mark King's Status KingBass, decorated with the 'Princess' from the cover of Level 42's first album.



1 HARDWARE

inside the bass

Since its inception in the early 1950s, the electric bass has seen major changes in both design and construction. But the core elements have stood the test of time, as is shown by first example used here for a detailed analysis of the instrument's components, a Fender Jazz Bass from 1966. The Jazz Bass was Leo Fender's second electric bass, its looks influenced by those of its contemporary, the Fender Jazzmaster guitar.

THE WORKS

The components of the electric bass are essentially a platform on which the string vibrates. Use a different platform and you'll get a different sound, which is why so many basses sound different. If the platform stayed the same, all we'd be concerned with is the differences in the strings and the player's technique. But guess what? That's another two chapters further on...

Body

Most bass guitar bodies are made from wood. In the case of a bolt-on or set-neck model, the entire body is constructed for assembly to the neck via a recessed neck pocket. In the case of a through-neck design, the body is merely two wings attached to the sides of the neck. Materials vary and often there is disagreement as to the best choice; this is largely due to the body material having to serve several requirements. It must sound good, be easy to shape, have stability, and be receptive to various finishes. At the lower end of the market basswood is a common choice; more upmarket instruments tend to favour old favourites such as alder, mahogany and ash. Use of more flamboyant woods for their visual appeal include flamed maple, birdseye maple, quilted maple, spalted maple, wenge, redwood, zebrawood and paduak. These are rarely used for the entire body, because of cost, availability, and tonal characteristics, although Pedulla has made its MVP and fretless Buzz instruments with wings of solid flame maple for many decades. Warwick is another company that likes to eschew tradition with its Thumb basses being made from ovangkol, whether of bolt-on or through neck varieties.

Some companies have produced bodies from materials such as graphite; UK bass maker Status is one well-known example. All-graphite construction is found on its Stealth basses. Graphite is largely an inert material; one tends to hear more of the actual string sound with little colouration.

Earlier attempts at using alternative materials met with little success. Ampeg's Dan Armstrong bass was made from solid Perspex and looked great, but sounded average and carried excessive weight. Currently, German company Sandberg offers a Perspex bass model for Rammstein bassist Oliver Riedel. The finishing touch is a built-in light system that casts an eerie green glow throughout the instrument. Ibanez employs Luthite, a man-made material in its Ergodyne series of instruments that feels, sounds and weighs somewhat closer to the wood ideal. Steinberger solved the body material problem on its ground-breaking headless L2 bass by having virtually no body attached to the neck other than an extended bottom bout to house the controls. What remained was constructed from graphite in one mould with the neck.

Body shapes, by and large, still follow Fender's original designs. True, some have longer horns, deeper cutaways, and more pronounced contouring. Alembic basses in particular

WHAT'S THAT WOOD?

In our discussions you will hear mention of many woods: ash, mahogany, rosewood, etc. There are many types of wood, and huge differences exist between what at first glance might seem similar types.

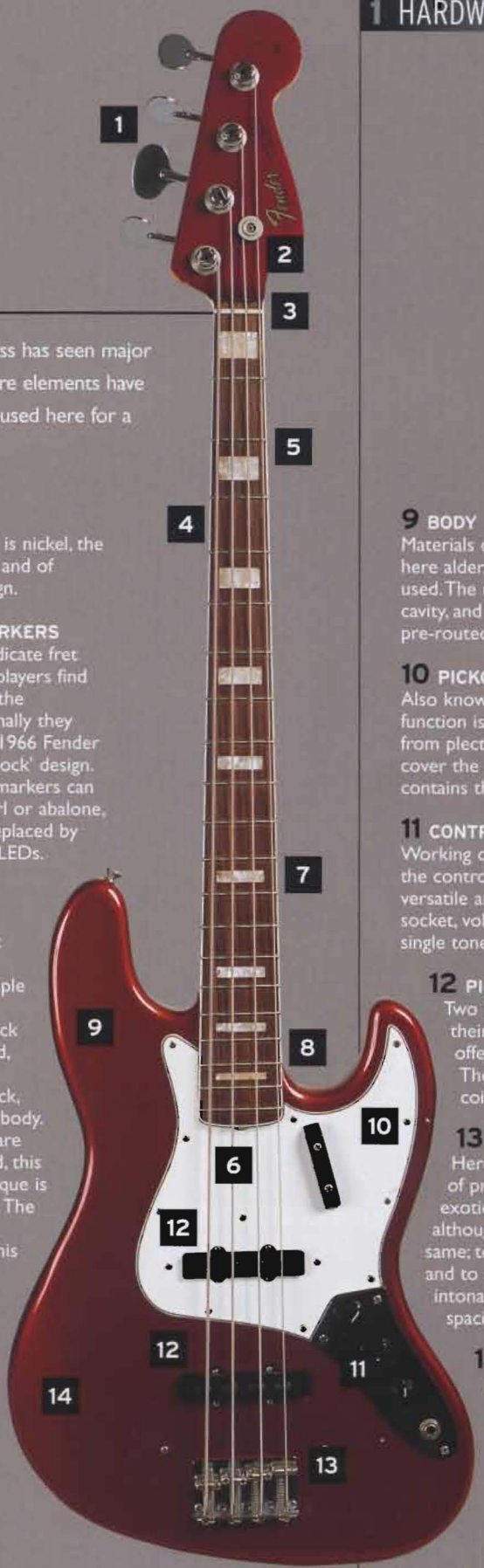
Some manufacturers are even deliberately coy about mentioning the exact type of wood as it can make the bass seem more exotic than it really is. Ash is a great example. European ash is a heavy, dense wood, but American ash, especially swamp ash, is a lighter wood with warmer tonal characteristics. Both might be described as ash, but they sound, weigh, and feel completely different.

Birdseye maple is a hard figured wood; flame maple much softer. Brazilian rosewood is one of the most musical woods and highly regarded for its natural beauty and sonic properties. It is also a highly endangered species due to rainforest logging activities. More commonly, rosewood will refer to Indian or other rosewood variants. CITES (the Convention on the International Trade in Endangered Species of Wild Flora and Fauna) aims to encourage the use of more sustainable woods.

As well as the material and design of a wooden bass, how the wood is cut can influence an instrument's structure. The cheapest method is to use flatsawn wood. Here the log is cut in planks down its length utilising nearly the entire tree. This makes for a cost-effective method but not one that is preferable to quartersawn planks, whereby the centre piece of the tree is used. Grain direction is much more stable using this method, although the cost rises accordingly.

1966 FENDER JAZZ BASS

Since its inception in the early 1950s, the electric bass has seen major changes in both design and construction. But the core elements have stood the test of time, as is shown by first example used here for a detailed analysis of the instrument's components.



1 TUNERS
Also referred to as machineheads, these steel posts both secure the string and allow tuning adjustments with a turn ration of 20:1.

2 STRING RETAINER
Also known as the string tree, this device pulls the strings downwards at a sharper angle than might be offered by winding the string around the post. Basses with angled headstocks overcome this problem.

3 NUT
The nut is a small but crucial piece of hardware, allowing the strings to be spaced and set for correct height and playability. Bone is a typical choice of material for many early basses.

4 NECK
The neck itself is made of maple with a separate fingerboard made of rosewood glued on to allow the adjustable truss rod to be inserted inside the neck. Maple and ebony are other common fingerboard materials.

5 FRETS
Fret 'wire' can be made of differing materials; in this case a hardwearing nickel/silver alloy is used. The number of frets can vary too. Here we have 20, giving a range up to E. A common practice today is to offer 24 frets, thereby increasing the range to G, an effective two-octave reach on each string.

6 STRINGS
Here the material is nickel, the gauge .045"-.105" and of roundwound design.

7 POSITION MARKERS
These markers indicate fret positions to help players find their way around the fingerboard. Originally they were dots, but in 1966 Fender introduced this 'block' design. Modern position markers can be mother of pearl or abalone, or may even be replaced by battery-operated LEDs.

8 NECK PLATE (HIDDEN)
The neck plate (at the rear of the body) offers a simple platform through which the four neck screws are located, allowing them to screw into the neck, securing it to the body. Although screws are nearly always used, this production technique is known as bolt-on. The serial number is located here on this 1966 model.

9 BODY
Materials can vary widely but here alder, a common option, is used. The neck pocket, pickup cavity, and control sections are pre-routed.

10 PICKGUARD
Also known as a scratchplate, its function is to protect the body from plectrum strokes and cover the machined routing that contains the electronics.

11 CONTROLS
Working on a passive system, the controls are simple yet versatile and include the jack socket, volume per pickup and single tone control.

12 PICKUPS
Two pickups are fitted, as their different locations offer alternative tones. The pickups are single-coil models.

13 BRIDGE
Here the bridge is a piece of pressed steel. More exotic alternatives exist, although the function is the same; to secure the strings and to allow adjustment for intonation, height and spacing.

14 FINISH
A high-gloss lacquer is used, with the headstock finished in the same colour as the body.

A Perspex-bodied Ampeg Dan Armstrong bass from 1970 (left). A Bich bass by B.C. Rich from 1985 (right).

have very ornate body styles, but the basic shape is still there. Other than the body-less Steinberger, only BC Rich managed to come up with any production alternatives to the norm, relying on wildly exotic shapes as its standard in-house style. Its Mockingbird, Warlock and Ironbird designs form part of the over-the-top style of many great rock and metal outfits. In fact BC Rich creates news when it comes up with a *less* outrageous style. Custom makers have more scope when creating body styles. Bootsy Collin's Space Bass by Larry Pless is one such example, currently available as a Washburn signature series instrument. Warwick and Status both produced versions of a John Entwistle design, known as the Buzzard bass; the instrument resembles a bird in flight.

Finishes are normally high-gloss lacquers of nitro-cellulose or polyester, the former being preferred for its ability to let the finish breathe and therefore improve the sound, the latter preferred by manufacturers for its tough finish and quick drying properties. Wipe-on oil-based finishes take the "let the wood breathe" principle even further, but offer little resistance to knocks, stains and scuffs.

A modern finish that seeks to provide the best of durability with the sonic benefits of nitrocellulose is acid-catalysed lacquer.

Neck

There are three construction options: bolt-on, set-neck and through-neck.

BOLT-ON

Despite their name, these designs use screws to hold the neck onto the body. The screws pass through the body into the neck and are supported either by a neck plate, as in Fender-style designs, or in individual recessed cups as found on Ibanez instruments. The benefits are ease of manufacture, easier service requirements – you can remove the neck to work on the fretboard – and a distinct tone that's smooth and rounded. You will get movement, however, as the neck settles into its pocket space. Companies have attempted to rectify this slight flaw by using six screws instead of the more common four or by inserting reinforcement plates into the structure for extra rigidity, as in Billy Sheehan's Yamaha Attitude Limited II bass. Fender, Music Man, and G&L (all companies with historical connections with Leo Fender) favour the bolt-on approach. Some companies, such as ESP, feature bolt-on, set-neck and through-neck designs in their catalogues.

SET-NECK

Also known as glued-in necks, these use a recess in the body to couple the neck to the body. Gibson is perhaps the best-known user of this method, although PRS has also adopted it on its high-end basses. The advantages of a set-neck are its strength and

2006 PEAVEY CIRRUS FIVE-STRING

Despite the continuing popularity of vintage or vintage-style instruments, many players prefer the reliability and modern features of newer designs. Peavey's Cirrus bass represents a contemporary five-string instrument, in which little attention has been paid to tradition in an attempt to create the best tone and playability possible.

1 TUNERS
Lightweight for better balance and fully enclosed for long service life and smooth operation.

2 HEADSTOCK
The neck-through construction is often accompanied by an angled headstock, eliminating the need for string retainers. In addition, a facing of graphite is applied for additional stability.

3 NUT
Wider, to accommodate our fifth string, and constructed from a modern material, graphite.

4 NECK
This neck utilises the through-neck construction method, whereby the neck runs right through to the end of the bass. It is of a multi laminate design to add strength and to add visual interest. Sometimes through-neck construction is less obvious, as the top of the instrument can be capped by a further wood facing. Further neck stability is provided by graphite laminations set inside the neck.. The fingerboard is Pau Ferro and the scale length 35" (889mm).

5 FRETS
The frets are medium jumbo in profile and 24 in number, offering a full two-octave range per string.

6 STRINGS
Here the material is stainless steel, the gauge .045"-.130" (for the low B) and of roundwound design.

7 POSITION MARKER
A 12th fret inlay of abalone provides a visual representation of the first octave position. No other front facing fret markers are present.

8 BODY
The body here is far more exotic than on our bolt-on model; a combination of redwood, maple and alder is used for looks, tone and stability. The body actually consist of two 'wings' or sides that are glued to the through-neck. Deep contouring allows extra comfort whether sat down or standing up.

9 PICKUPS
Two pickups are fitted as on our Jazz Bass, but now offering a combination of two humbuckers. These are active pickups, requiring a battery for their operation and to power the active controls for tone shaping. Note the pickups' curvature to match the fingerboard radius.

10 BRIDGE
Gold plated and adjustable for height, lateral movement and intonation, the German made ABM bridge offers improved string clarity and sustain, thanks to its construction from a block of solid brass. The machined grooves provide resistance to lateral movement.

11 CONTROLS
Active electronics offer the ability to cut and boost frequencies. Power is provided by twin 9-volt batteries wired in series for an 18-volt system. The new flexibility offers wider tone shaping capabilities, hence the inclusion of bass, middle, and treble controls together with master volume and balance controls to replace the twin volumes found on our Fender Jazz Bass example.

12 FINISH
With a top of redwood, it would be a visual crime to cover this with a pickguard. Instead a durable high-gloss lacquer is applied. Accordingly, the controls are accessed via the rear control cavity. As the space is created on the back of the bass it is known as a rear rout body. For better feel, the back of the neck is finished with a urethane oil finish.

sustain. The disadvantages are cost and difficulties in servicing. If a set-neck has a flaw, sometimes only identifiable when the bass is finished, the whole instrument usually has to be scrapped.

THROUGH-NECK

Invented by Rickenbacker in the 1950s, the through-neck runs all the way through the instrument from peg head to strap button. It is often made in laminates, both for stability and appearance. By placing the bridge on the same piece of wood as the fingerboard and neck, sustain and clarity are claimed to be much improved. Through-neck instruments certainly sound different to bolt-ons. Previously, they were always seen as being luxury or improved versions of bolt-ons but it is now accepted that each design has its own advantages and, perhaps more importantly, distinct sound. Early Gibson Thunderbirds, various Alembics, Spector, Tobias, Overwater, and Carvin are just some of the basses that employ through-necks.

Above: three ways of connecting the neck. Through-neck, on the Peavey Cirrus (left); set-neck on the Gibson EB-3 (centre); bolt-on on the Fender Jazz (right).

The scale length of the neck will have a great effect on the sound and feel. The scale length is the measurement from the nut to the bridge. More precisely, it is double the measurement from the edge of the nut, where the string leaves it, to the 12th fret. This is known as the 'speaking' part of the string – what goes on behind that point is somewhat irrelevant in terms of scale length, although it can affect feel.

The bridge is adjustable, usually with individual saddles so that the instrument can be be given correct intonation (see Maintenance, p64), taking into account the variety of string gauges available; that's why a measurement taken to the saddle might produce slightly erratic results.

Leo Fender got the balance between playability and tone just about spot on with his 34" (864mm) scale length calculation. It is now an industry standard. Shorter scales vary around the 30" (762mm) range, Gibson's earlier instruments favouring 30.5" (775mm) scale lengths, and Hofner a straight 30" (762mm). Now anything less than 34" (864mm) is referred to as a short (30"/762mm) or medium (32"/813mm) scale instrument. Recently, with the development of five-string basses and their heavy gauge low B strings,

scale lengths of 35" (889mm) or even 36" (914mm) have been used. Kubicki's Ex-Factor bass uses a 32" (813mm) scale length plus an extended fingerboard reaching 36" (914mm) on the low E-string. A small lever, when moved, exposes two further frets extending the E down to a low D and creating the extra scale length. A great idea,' but not a new one; a similar mechanism appeared on double basses centuries ago.

Materials for necks also vary greatly. Maple is the number one choice for bolt-ons as it is hard and stable. Mahogany is another choice for glued-in necks (not bolt-on), and recent trends are seeing ash being employed more widely. Graphite is a more exotic and costly alternative but offers the ultimate in stability, being impervious to climatic changes that could have a wooden bass requiring adjustment. Modulus created the first graphite or composite neck back in the 1970s. After serving companies such as Alembic and Music Man, they soon branched out into complete instruments and were later followed by Status in the UK and Zon in the US. As a testament to some bassists' preference for graphite, all three companies are currently producing instruments employing various degrees of graphite in their construction.

Materials and design of the neck matter because they affect feel and sound. One Holy Grail of the bass maker is to remove dead spots from the neck. A dead spot is a note on the neck that feels lifeless in tone and sustain compared to the others (see Maintenance, p64). Removing it (or simply moving it to a less noticeable place) can be influenced by the materials used and is one of the claimed benefits of graphite.

The feel of the neck is also influenced by its width and profile. This refers to the shaping of the back of the neck. Common profiles include C or V types, the former being rounded, the latter with a more pointed centre to its shape. In practice the neck profile varies greatly between manufacturers and is a reason why some of us prefer one instrument to another. Some makers even use an asymmetrical profile whereby the left and right hand sides of the neck are shaped differently.

One material that has met with less success is the aluminium neck. Gary Kramer and Travis Bean combined forces to create the aluminium- and wood-necked TB2000 bass in 1976, but after several decades of playing wood, some players resisted its cold feel. Hartke, which pioneered the aluminium speaker cone, had another go in the 1990s with its XL-4 Bass. To overcome the previous feel issues, Hartke's design employed an outer wooden neck shell and a T-section aluminium inner assembly. It was claimed to have an unmistakeable sound, but it would appear that it was not a success with the buying public.

Wooden necks require a method of adjustment to set the neck's relief (see Maintenance, p64), a curvature set into the neck to allow the string to vibrate correctly and to counter the extreme tension caused by the strings as they are

The standard (34"/864mm) scale-length Fender Jazz, compared with the short-scale (30"/762mm) Fender Mustang.

The aluminium-necked Travis Bean TB2000 of 1976.

tuned to pitch. Most are based around a steel rod inserted into a channel in the neck with one end fixed and the other threaded and adjustable. Tightening or loosening the rod varies the pressure on the neck, thereby adjusting relief. Many variations on this simple device exist, and some graphite necks do away with the truss rod altogether, such as those used by Zon in their Legacy and Sonus instruments. Other graphite makers employ a truss rod within the carbon shell, a system used by Status and Modulus.

The type of finish greatly affects feel and many players remove the sheen from their necks by rubbing them down with fine wire wool or 1200 grade wet-and-dry paper. Modern materials developments allow some maple necks to be finished with an oil-based product, although some staining from the hands is likely if the bass is used regularly.

Fingerboards

Rosewood and then maple are the two most common options for fingerboard material. Maple is more dynamic, rosewood slightly softens the tone. Which is best depends upon personal preference and the remaining woods used in the instrument's design. Ebony is even harder than maple and favoured by many for fretless fingerboards. Phenolic fingerboards are often employed by companies utilising graphite necks; the material consist of a mixture of graphite, resin and wood to give a somewhat more organic feel to the fingerboard. That all-important feel can be missing when using pure graphite.

Traditionally, maple fingerboards had a high gloss lacquer applied to them, whilst rosewood was sturdy enough with either an oil or light coating of finish. Today many maple boards are without gloss lacquer finish, to improve feel.

Feel is also affected by fingerboard radius. The radius is the curvature of the fingerboard; as you sight the neck it appears as a camber between the lowest and highest string. The radius can vary and is measured by reference to the diameter of a circle (imagine cutting off the very top of the circle – that's your fingerboard curve). The lower the figure, the tighter the circle and therefore the steeper the curve.

Vintage Fenders employed a relatively steep fingerboard radius of 7.25≤ (184mm), whilst their modern counterparts employs a lesser curve of 9.5≤ (235mm). The steeper radius seems to appeal to players playing in the lower positions, whilst the gentler radius works well for upper register playing, especially if you use string-bending techniques, where steep radius boards can cause the string to 'choke'.

One perfect but costly solution is the compound or conical radius whereby a steeper radius is employed lower down the fingerboard and a gentler radius further up, as found on the Modulus Quantum basses

Frets

Two octaves are achieved with 24 frets, although playing up the top end of the bass was largely frowned upon in the instrument's early days, when 19, 20 or 21 frets were more common. With soloing on the bass granted full clearance after Jaco's fretless exploits, greater ranges than two octaves have been achieved, notably by Warwick with its 26-fret Dolphin and Thumb bass models.

The frets themselves can vary in shape. Tall and thin, fat and wide, or multiple variations thereof, the fret profile will influence how the bass feels when played. And the fact that the frets are a direct coupling to the fingerboard itself will mean they also

influence the sound. Material is often a nickel/silver alloy. Warwick favours an alloy it calls bell brass.

Nut

Nut materials were normally reliant on natural resources, bone being the most common option as it is tough and easy to work in order to cut the slots. Brass was favoured during the 1970s with claims of extra sustain being touted, although it is hardly seen today. Instead, graphite nuts are more common, their slightly more slippery surface allowing the string to move and then return to its original position when playing hard or during tuning.

A zero fret placed in front of the nut is sometimes employed as a different method of starting the speaking length of the string. It needs to be very slightly higher than the other frets as it's now used for the open-string sounds. The nut is employed as a spacing device in this instance.

The latest development in nut technology is the compensated nut, popularised by session guitarist Buzz Feiten. The Buzz Feiten system examines the laws of acoustics that explain why playing in certain keys can sound in tune while others sound very slightly out of tune. The system uses certain calculations and a special type of shelf nut that overhangs the edge of the fingerboard to compensate for anomalies that those with a fine ear will appreciate. Fitting is technical and involves an authorised service centre. You can't argue with the science, but you may wonder why it's not been a problem for you previously. Once demonstrated (it's particularly noticeable on guitar chords) it makes a compelling case. Some manufacturers now fit compensated nuts as standard practice.

String spacing also affects playability. The nut determines how far from the edge of the fingerboard the outer strings lie and also the spacing across the fingerboard. Some makers employ an equal-string nut cut, whereby each nut slot is cut equally between the centres of each string. Others prefer to space the nut slots taking into account the actual string thickness. The resulting nut will then have unequally spaced slots but the player will feel each string under his hand at an equal distance.

Pickups

Passive pickups employ simple physics to amplify your bass signal. A wire coil wrapped around a magnet generates a current when stimulated by the movement of the string. That signal is sent to the output jack and then to an amplifier to make it audible, although it may pass several other controls or circuits before it reaches the jack. Pickups usually use either single-coil or humbucking principles.

Active pickups still employ magnets and wire but require powering by either a battery or alternative power source such as phantom power (power is sent back down your cable by the amplification source) or adaptor. Normally a 9-volt or 18-volt battery circuit suffices. By offering a powered signal before it reaches your amplifier, active pickups can be of low-impedance design, allowing more flexible tone-shaping circuitry, extremely low-noise operation, and long cable runs to be used without the signal losses common on passive instruments. Neither active nor passive designs are seen as better or worse than each other – there are cheap active basses and expensive passive ones – but certain players tend to have preferences. There are three basic designs of pickup: Precision or P-style, Jazz or J-style, and humbucking.

A selection of replacement pickups.

PRECISION OR P-STYLE

Based on the split-pickup design of Leo Fender's 1957 Precision bass, this model is split into two halves, with one half for the E- and A-strings and the other, lower-set half, covering the D- and G-strings. This clever design allowed a hum-cancelling operation to be performed by using two separate coils wired in series. By using two smaller magnets either side of each string, tone and gain were improved. The only disadvantage of this style pickup is in its installation – a clean accurate rout is required into the wood.

The sound: punchy, deep, growling bottom-end and rich highs make this a universally popular choice. The Precision-style pickup can be heard on millions of great rock, soul and blues recordings.

The three main types of pickup, P-style (on a Fender Precision), J-style (on a Spector), and humbucking (on an Aria SB1000).

JAZZ OR J-STYLE

The use of P- and J-style abbreviations is to avoid the copyright terms owned by Fender, although it is clear what these models are based on. The Jazz-style pickup as found on Leo Fender's Jazz Bass comprises a regular single-coil with four mounting lugs and again twin pole pieces per string. Used in isolation it will be noisier than a hum-cancelling design, but when used with a second pickup, a hum-cancelling effect is achieved; hence its almost universal adoption in twin pickup set-ups.

The sound: brighter, clearer and smoother compared to the P-style pickup, and subsequently loved by funk, fusion, and blues players alike.

HUMBUCKER OR SOAPBAR

Humbucking or hum-cancelling pickups are based on a design pioneered by Gibson electronics designer Seth Lover. Wanting to reduce the level of hum and interference that can be present in single coil designs, Lover looked to amplifier designs that employed a second 'choke coil' to reduce transformer hum and transferred the idea to his revolutionary new pickup, which was then featured on the Les Paul guitar to great acclaim. The principle is simple enough; two coils are employed, each with opposite

magnetic polarity but wired together to form one unit. The result is indeed a pickup that is less susceptible to noise and interference, hence its popular employment as a single pickup on many basses, for instance the Music Man StingRay. In addition however, it produces a different sound to single coils, having both a greater output and a thicker, darker sound.

Working on hum-cancelling principles, any pickup shape can theoretically be a humbucker. In order to reduce hum from J-style pickups used individually, some pickup makers stack one coil on top of another to create a humbucker mode in a single-coil sized housing. Most players think of humbuckers as consisting of two coils sitting side by side. This larger housing, magnet structure and string sensing area tend to give the sound we associate with humbuckers.

The term soapbar refers to the shape of the common humbucker pickup. Yep, it looks like a bar of soap. A soapbar pickup may however contain the guts of a single-coil design, or even a tri-coil design as found in Music Man StingRay 5 basses, allowing series, parallel and single-coil modes from a selector switch.

The sound: loud, darker, and more mid-range than the single coil. The modern humbucker has found universal favour especially when combined with a single coil pickup.

Pickup position

Where the pickup is fixed to the bass has a massive influence on the resulting tone. A J-style pickup close to the bridge will sound hard, thin and bright; placed close to the neck it becomes warm and full. The obvious answer is to use two or more pickups, one in the neck and one in the bridge position and add extra volume or balance controls to mix between the two. Makers favouring the single pickup approach search for the 'sweet spot', a point on the instrument where a blend of warmth, punch and clarity can be found after much experimentation, usually right between the bridge and neck positions. But there are always exceptions; the Music Man StingRay, a bass with a single humbucker, sounds characterful, warm, and aggressive by using a single humbucker close to the bridge. Let your ears be the final judge in all cases.

Controls and circuits

The simplest passive controls normally consist of a volume per pickup and a tone, sometimes per pickup or as a master controlling all the pickups. Operation is through a device called a potentiometer or pot.

Pots are comprised of a strip of conductive plastic with a connection at each end and a wiper contact that slides over the strip. Each pot is identified with a number that represents the maximum resistance value of that pot. So a 500k pot provides 500,000 ohms of resistance when it's fully rotated. Most single coil pickups, for example those found in a traditional Jazz Bass, will use 250k pots; humbuckers, with their greater output, favour 500k values while active pickups will use 100k pots or, in some cases, 25k or even 10k.

The way the resistance changes as the wiper slides across the conductive strip is called the taper. The two types of pot tapers found on basses are linear and audio (or logarithmic). A linear taper pot changes resistance linearly, that is, when it's rotated 25, 50 or 75 per cent of the way from one side to the other, the total resistance is 25, 50 or 75

SERIES AND PARALLEL

Series and parallel switches allow various wiring combinations to be altered to give different sounds and outputs.

Series wiring joins the positive connection of a first component to the negative connection of the second. The remaining positive and negative connections provide the combined output of the two components. In the case of two 9-volt batteries, we now have an output of 18 volts. Or, if we chose to wire together the two coils of a humbucker, we would add together the outputs of the two coils. Think of series wiring as being 'serious' – you're getting more clout.

Parallel wiring has the positive connection of the first component joined to the positive connection of the second component. The two negative connections are similarly joined together. Now the two components are said to be working in parallel. In the case of wiring our two 9-volt batteries, the end result would still be 9 volts but with much extended battery life. Wiring together the two separate coils of a humbucker in parallel would give a lesser output than the series option and a change of tone as well.

Music Man Sterling basses employ this system, using the twin coils of their single humbucker. The system is also relevant in wiring together individual speakers within a cabinet. Thus two 8-ohm speakers can be wired to give 16 ohms (series) or 4-ohm (parallel). In this case, the parallel wiring would get greater output from our amplifier, due to the reduced impedance load compared with connection in series (see Bass Loudspeakers, p93).

Three bridge designs. The twin-saddle bridge of a Fender Telecaster Bass (top); the fixed-saddle bridge of a Gibson EB-2 (middle); and the fully-adjustable modern bridge of an Alembic Mark King (bottom).

per cent, respectively. In the case of an audio taper pot, the resistance is logarithmic, which is closer to how the human ear hears. In this case, a 50 per cent rotation may yield only 15 per cent of the total resistance. So, for example, a 100k linear pot set half way will read 50k. A 100k audio pot set half way will only produce around 15k ohms of resistance. Keep in mind, there are also audio taper pots with 5 or 25 per cent of total resistance at the halfway point of rotation, but 15 per cent is most commonly used in basses.

In the case of passive tone controls of the type found on traditional 'vintage' basses, audio taper tone pots are used to attenuate or 'roll off' the treble response in your tone. Despite what you may think, a passive tone control does not add brightness – all it can do is cut the tone to give a duller sound. High-end roll-off is controlled by a capacitor soldered to the pot. Its value determines how much high frequency is removed from the signal.

Concentric or stack pots comprise two pots occupying the space of one. The bottom control controls one operation, the top a second function. They are commonly found on active circuits to keep crowding down, although the 1960 variant of the Jazz Bass sported passive concentric pots, a volume and tone per pickup.

Active tone circuits are used to boost or cut a certain frequency from a centre point, often marked on the pot with a detent or notch that can be easily felt while turning the knob. In this case, the circuit board generally requires a power source, for instance a 9-volt battery or, in some cases, two batteries. Here, linear taper is more common, although some companies, such as Basslines, often use a special potentiometer that employs audio taper when rotating the knob clockwise from the centre detent, and reverse-audio when rotating the knob counter-clockwise.

Active circuits usually compromise bass, treble, volume, and balance or pan pot controls. The pan pot works well on an active circuit by avoiding certain phase cancellations that can occur when attempting to blend different mixes on passive basses using twin volume pots. Contrary to popular belief, though, passive basses can use passive blend controls; Yamaha's RBX range being a good example. Mid controls are often added to active circuits, sometimes with an extra frequency control to allow semi-parametric operation. This is when concentric pots become useful, as finding space for six pots can look cluttered. Other controls on actives are limited only by the designer, and all sorts have been employed over time. Mid-boost switches (Zon Sonus, Pedulla's wonderfully named Thunderguts), mid-cut switches (Status KingBass), bright switches (Status S2), and built-in effects such as wah and slap contouring (Cort T.M. Stevens) are all possible with active circuits.

Most active circuits work from one, two or even three 9-volt batteries and are switched using a special jack socket called a switching jack. This activates the circuit when you insert a jack plug (phone plug). By the same token, it will drain the battery if left in when not in use.

Shielding or screening is the term employed for preventing outside electrical interference emerging as part of your bass sound. It usually comprises either screened cable, copper foil wrapped into the control cavity, or the application of a special screening paint. Sometimes it can be a combination of the above.

Tuners

Also known as machineheads or tuning pegs, they keep your bass in tune and secure the string in place. Think of them as winches working on the worm gear principle. Two common types are found, open-geared and enclosed. The open-geared style is the oldest design, found on many instruments such as Fenders, Gibsons, and variations of those classics. Easy to use because of their large 'buttons' the quality of this style can vary immensely. Cheap instruments may have tuners machined to poor tolerances and can be stiff or slip in use. High-end models, such as those offered by Schaller or Gotoh, offer precise tuning.

In the enclosed type, the gear wheel and worm shaft are sealed into a maintenance free housing. They tend to be smaller and more compact than the traditional open gear styles. This affects balance and can make a sensible upgrade to a bass. Firms such as Hipshot now offer ultra-light versions of open-geared tuners to maintain the appearance of older instruments whilst reducing weight. Their excellent D-Tuner is a clever device that looks like a standard machine head but rotates on a second mounting plate to a set distance via a threaded wheel and lever mechanism. Moving the entire assembly allows you to drop tune a string (normally the E but it doesn't have to be – bassist Michael Manring uses four!) to a preset pitch, up to two tones down. Although this may require string gauge adjustment to retain tension, it appeals to the super low-ender who can't get on with five-string basses.

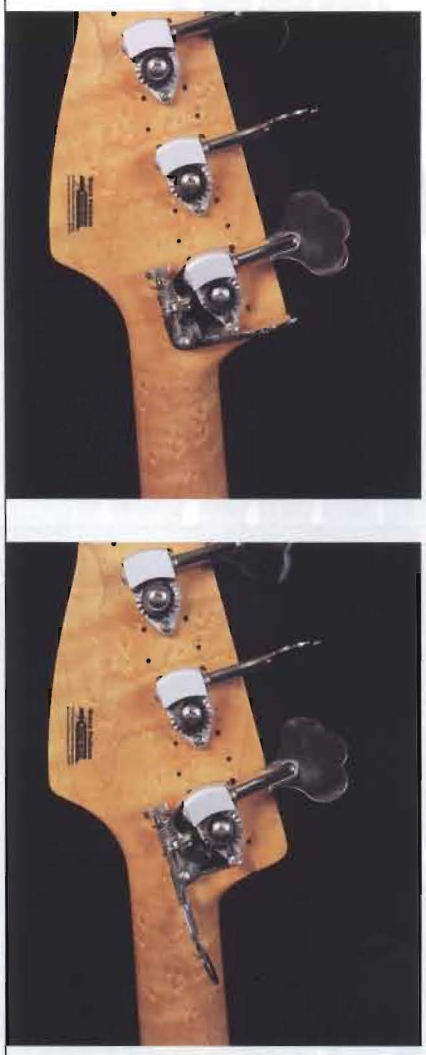
Bridge

The bridge has to anchor the strings, allow easy string changes, and offer adjustment of the saddle length for intonation and saddle height for the bass action. With these criteria, it's easy to see why the 1957 Precision bass bridge, a simple, workmanlike design, still prevails on most instruments. Fender's original design for the 1951 Precision shared many of these features, except that it offered just two saddles, each carrying a pair of strings, meaning exact intonation and height adjustment was compromised. It was a better effort, however, than Gibson's offering, which featured one fixed pre-intonated saddle, or Hofner's halfway house, in which small steel fret inserts could be placed in one of three channels sunk into a wooden bridge assembly.

The bridge may be one integrated mechanism or divided into separate bridge and tailpiece assemblies, the latter to anchor the strings in place, as found on Warwick basses.

Some bass designs offer through-body stringing whereby the string passes over the bridge and down through the body via four (or more) holes. To stop the body wearing, hard steel or brass string ferrules are fitted in which the string ball-end sits. The idea is that the string's energy is transmitted right through the body thereby improving tone and sustain.

Most bridges are constructed from pressed steel, but top-flight models favour more exotic construction. For instance, the Badass bass bridge, a favourite with custom makers, incorporates a high-density zinc alloy design to increase mass, and precision milled components for rigidity and fine adjustment.

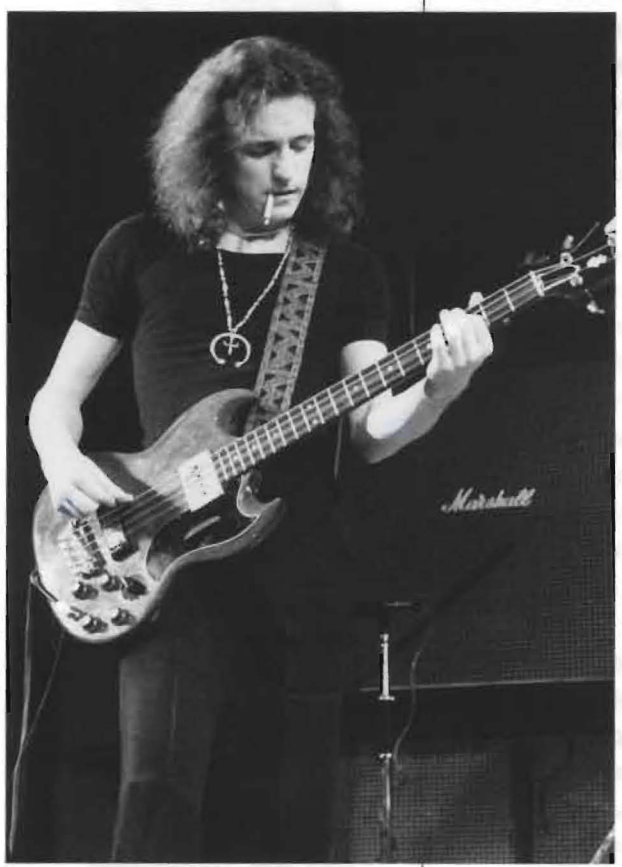


The Hipshot D-Tuner, a simple mechanical device that allows you instantly to drop the pitch of a string.

VINTAGE CLASSIC: GIBSON EB-3

History

Gibson's electric bass line-up has always dwelt in the shadow of the mighty Fender, a bitter pill for Gibson to swallow were it not for the fact that its electric guitar range became iconic and successful, with models such as the Les Paul and ES-335 favoured by rock, blues and jazz giants all over the world. The EB-3, confusingly, was Gibson's fourth model to be developed following the 'violin' styled Electric Bass (later renamed the EB-1), the 335-esque EB-2 hollow body model and EB-0 introduced in 1961, the same time as the dual pickup EB-3. There are many reasons offered for the lack of popularity of the EB basses. All featured shorter 30.5" (775mm) scale lengths, which, although easier to play for the guitarist switching to bass, resulted in a tone lacking depth and clarity when compared to Fender's 34" (864mm) scale length. Although the Fender's dimensions are accepted as an industry standard now, during the 1950s and 1960s it was open to any manufacturer to propose its own scale length. Fender got it right though, and 34-inch is still the standard today. One attempt to follow Fender's role model was made with the EB-3L, a long scale (34.5"/876mm) version of the EB-3.



Jack Bruce of Cream with his Gibson EB-3.

The Gibson EB-3 is no longer in production, despite various upgrades throughout its history. A bound fingerboard and slotted headstock, similar to a Spanish guitar head, appeared and disappeared in the 1970s; and the single-saddle bridge became a four-saddle version. It's possible that the EB-3 was destined for the bass history dustbin were it not for the exploits of Jack Bruce, who chose the EB-3 to record Cream's *Disraeli Gears*. In a similar fashion to McCartney's use of the Hofner 500/1, Bruce's adoption of the EB-3 ensured that it is now fondly remembered, collected and respected. Famous EB-3 users included Free's Andy Fraser and Trevor Bolder, who was the bassist for David Bowie's Spiders from Mars band.

The EB-3's finishes were limited to cherry red, walnut, black and white, although custom colours such as Pelham Blue have appeared from time to time.

One distinguishing feature of the EB-3 was its use of the glued-in or set-neck design. Although this was successful on Gibson's guitars, any benefits of extra sustain on a bass were lost owing to the decision to use a reduced scale length. Quality suffered after the mid 1960s, just as it had at Fender and many other makers that enjoyed the 'benefits' of corporate buy-outs. Yet for all its potential quirks, the EB-3 offered a fat, warm sound with little high-end, ideal for shaking the floor with a pair of 1 x 18" cabinets.

Players

Jack Bruce was pivotal in creating a vibe around the EB-3 and several other players have probably been influenced by Jack and the EB-3 rather than actually using it. Trevor Bolder admitted, "I don't like a lot of treble, probably because I played a Gibson EB-3... and liked that Jack Bruce sound." Billy Sheehan, a fan of Bruce and EB-0 user Paul Samwell-Smith

VINTAGE CLASSIC: GIBSON EB-3

YEAR: 1965
BODY: Mahogany
COLOUR: Cherry Red
NECK: Mahogany, set-neck
FINGERBOARD: Rosewood
PICKUP: Two humbuckers
CONTROLS: Two volume, two tone, four-way rotary selector
SCALE LENGTH: 30.5" (775mm)
HARDWARE: Chrome

from The Yardbirds, wasn't keen on the short scale Gibson basses but loved the 'woof' the neck humbucker kicked out. He soon modified his 1969 Fender Precision to incorporate a Gibson EB-0 pickup to achieve the best of both worlds, a feature he still employs on his own Yamaha Attitude Limited II bass. Cream's reunion concerts have certainly sparked renewed interest in the EB-3 and Bruce's EB-1, which he employs on several live tracks.

VINTAGE CLASSIC: FENDER JAZZ BASS

History

The Fender Jazz Bass was the second milestone in the career of Leo Fender, following his success with the Precision Bass. By 1960, with the Precision Bass now well established, and competitors such as Gibson and Rickenbacker creating rival instruments, Leo and his team came up with an instrument that was seen as an upmarket or luxury version of the Precision. The Jazz Bass sported an offset-waist body, two single-coil pickups and, initially, two stacked controls (one per pickup), covering volume and tone. As with the Precision, it had a 34"(864mm) scale neck, a scale length that eventually became accepted as standard for bass guitars. It also featured a slightly narrower neck profile at the nut, which created tighter string spacing and gave the bass a different feel to the Precision.

Since its introduction in 1960, the design of the Fender Jazz has not changed a great deal, save for minor modifications. However, these minor details do characterise each particular variation of the bass and are essential to get right when it comes to distinguishing the various eras of the instrument. Distinguishing features of early models include the aforementioned stack knobs (such versions are now regarded as a holy grail of collectors and enthusiasts) as opposed to the three-control design that appeared towards the end of 1961 and the Fender logo in gold on the early models: it was eventually replaced with the black logo in 1969 (more prominent on TV shows broadcast in black and white) until the silver chrome version, which appeared around 1995. Very early versions of the Jazz also featured adjustable individual string mutes, but these, together with the chrome bridge and pickup covers, disappeared over time.

The instrument was originally available in a variety of finishes due to the extra cost option of custom colours, made popular by auto paint specialists Dupont. With exotic names such as Burgundy Mist, Candy Apple Red, Olympic White and Lake Placid Blue, these finishes are now highly desirable amongst collectors.

Although the 1970s saw few innovations for the Jazz Bass, the model range began to grow in the 1980s with the introduction of the Reissue series. Fender was approaching a turbulent time in its career and began to rely on past glories to keep sales buoyant. The 1962 Reissue Jazz Bass was a replica of the 'stack-knob' instrument that Fender first introduced and is still available to this day.

After CBS sold out to Bill Schultz and other Fender executives in 1985, the Jazz Bass, like many existing Fender instruments, was about to experience a growth in model range that now runs to hundreds of variations for each instrument. Expansion began when Fender opened the Fender Custom Shop, a facility necessitated by the company's desire to provide individual customers with any special feature they wanted. As unique models

VINTAGE CLASSIC: FENDER JAZZ BASS

YEAR: 1960
BODY: Alder
COLOUR: Olympic White
NECK: Maple, bolt-on
FINGERBOARD: Rosewood
PICKUPS: Two single-coil
CONTROLS: Two volume, two tone
SCALE LENGTH: 34" (864mm)
HARDWARE: Chrome

began to emerge from the Custom Shop, many ideas found themselves incorporated into new production line models. A five-string Jazz Bass appeared in 1990 and active electronics were incorporated into the new American Standard model to create the Jazz Bass Deluxe. A new Standard Jazz Bass emerged in 1995, incorporating high tech materials such as graphite to stabilize the neck. The current US-made Jazz Bass is known as the American Series, leaving a Mexican-built model to inherit the Standard tag.

Special models

There have been a number of special models in Fender's history, but recently that trend has increased significantly with limited-run specials from the Custom Shop. One of the most sought after is probably the Jaco Pastorius Signature Jazz Bass, which was introduced as a limited model in 1991. Only 100 were made, as an exclusive for the (now defunct) Bass Center in Los Angeles, making them extremely difficult to find. As well as being a faithful reproduction of Jaco's favourite bass it came with a signed certificate from Jaco's technician, Kevin Kaufman, and John Page from the Custom Shop. The Custom Shop now offers a pre-worn and aged model, The Relic Pastorius Tribute Bass.

Fender has celebrated various anniversaries with special models, and again the Jazz Bass was no exception. Fenders 50th birthday saw the introduction of a model with a flame maple top and gold hardware in both four- and five-string versions. Other bassists who have had custom signature instruments made include Marcus Miller, Mark King, and Stu Hamm. All feature alterations to the original design. Marcus Miller's bass has custom jazz pickups, a Badass bridge and a two-band active EQ. Mark King's bass featured SimS LEDs, while Stu Hamm's bass was very radical indeed, with a shorter scale (32"/813mm), smaller body, and twin jazz pickups, plus a custom-wound P Bass pickup, capable of providing a vast array of sounds.

Players

Several names have been very closely associated with the bass during their careers. They include such session greats as Jerry Jemmott and Joe Osborn who, alongside James Jamerson (a fingerstyle bassist who played a Fender Precision), laid down the studio hits with little credit for their performances. But perhaps the most notable Fender Jazz user was the late Jaco Pastorius, who used a de-fretted 1962 Fender Jazz for much of his career. It's this bass, together with his fretted 1960 Jazz Bass (pictured with Jaco, opposite), that you will hear dominating classic bass albums like Weather Report's *Heavy Weather*, Joni Mitchell's *Hejira*, and his own eponymous debut album, which features such historic tracks as 'Donna Lee', 'Continuum', and 'Portrait Of Tracy'. Marcus Miller has also used a Fender Jazz for much of his career and today uses a natural 1977 Jazz Bass, with modified electronics by Roger Sadowsky, as well as the signature bass based on his original. Slap bass was virtually invented by Jazz Bass user Larry Graham, who found the warm neck-pickup tones of his instrument perfect for reproducing this new technique. And in the rock world, Led Zeppelin's John Paul Jones was to be found laying down riffs to such classics as 'Stairway to Heaven' and 'The Lemon Song' on a 1962 Sunburst model. Geddy Lee is often seen sporting an early 1970s Jazz with Rush, and, proving its enduring appeal, the Jazz Bass can currently be seen in action with bands such as Coldplay, and Glassjaw, and in Blink 182, where Mark Hoppus plays a curious Jazz/Precision hybrid.

OPPOSITE: Jaco Pastorius playing his fretted 1963 Jazz Bass, which had a replacement maple neck from a Precision Bass.

MODERN CLASSIC REISSUE: FENDER CLASSIC SERIES '50s PRECISION BASS

History

The story of the original mass production electric bass, the 1951 Fender Precision, crops up many times in the various historical perspectives throughout this book. Perhaps often overlooked is Fender's current Precision Bass range. After selling out to the giant CBS corporation in 1965, Leo Fender remained on board as a consultant, with a restrictive covenant forbidding him to produce designs for other companies. When that covenant expired, it came as no surprise to many, given Leo's passion for design and tinkering, that he formed Music Man in the mid 1970s and then G&L guitars in 1980. These years spawned further classic instruments, such as The Music Man StingRay. Back at CBS Fender, the Precision Bass still moved forward, the range expanding with increased options including the re-introduction of the early 1951 Precision as the Telecaster Bass. Cosmetic changes were also added; the larger, bolder, black headstock logo was brought in to make instruments more recognisable on television broadcasts, for example. By the early 1980s, Fender was already looking to its rich past by re-issuing designs such as the '57 and '62 Precisions and the '62 Jazz Bass, with its stack-knob control layout. Production was also boosted by instruments originating from Fender Japan, in a tie-up that attempted to save Fender's fortunes from the vast number of Japanese copy Fenders now appearing on the market. But in early 1985, after nearly 20 years of ownership, CBS decided it had had enough of Fender and sold the company to a management team headed by existing Fender president Bill Schultz. Production moved from Fullerton to Corona, California, as the original factories were not included in the sale. It was from this point onwards that the Fender Precision range began a seemingly never-ending expansion.

Model range

Today's Fender catalogue encompasses a bewildering range of Precision Bass instruments. The first radical change came in 1980 with the Precision Bass Special featuring an active circuit, brass bridge, white pickup, gold hardware and matching-colour headstock. An Elite variation appeared in 1983; features included a new bridge with fine tuners, twin Precision pickups (Elite II), active circuitry, and die-cast tuners. Luxury appointments on the Elite and Special did not extend to the new Standard Precision, which was given a cheaper, single-ply pickguard resulting in a very budget-looking instrument.

The 1990s saw the introduction of a new Precision Bass Plus, sporting a 22-fret neck and Lace Sensor pickups. Deluxe and upgraded Standard Precision bass models appeared, the Deluxe models featuring smaller or 'dinky' size bodies for a more modern look, and both featuring modern materials such as graphite in the neck for additional stability. The US Plus Deluxe models also incorporated active electronics. Japanese production was still important, with more affordable versions of the vintage instruments going under decade-specific, rather than year-specific models, including the 1950s and 1960s Precision Bass models. The most modern-style Precision to date, the Japanese Precision Bass Lyte, featured a deeply contoured downsize body of lightweight basswood, active EQ, Precision and bridge located Jazz pickups, and enclosed Gotoh mini tuning machine heads. The confusing Plus/Plus Deluxe nomenclature was dropped in the late

MODERN CLASSIC REISSUE: FENDER CLASSIC SERIES '50s PRECISION BASS

YEAR: 2006
BODY: Alder
COLOUR: Black
NECK: Maple, bolt-on
FINGERBOARD: Maple
PICKUP: Passive split-coil
CONTROLS: Volume, tone
SCALE LENGTH: 34" (864mm)
HARDWARE: Chrome

Mike Dirnt of Green Day with his Fender Precision.

1990s to establish a firm Standard/Deluxe series. US models are known as American Series and Deluxe Precisions now feature soap-bar style humbuckers at the bridge and a regular Precision pickup where one would expect it to be. Circuits are active with three-band EQ. Our featured example is a Classic Series '50s Precision Bass, made at Fender's Mexican factory. It incorporates authentic Fender details such as a lacquered neck, a gold anodised scratch plate, grooved bridge saddles, and a maple fingerboard, but it sells at a much lower price than its US-made equivalent.

Special models

The Special and Elite models were joined by the first exotic wood body variation, the Walnut Precision Special and Walnut Elite II P-Bass. A 100-piece Custom Shop limited edition James Jamerson Tribute Bass was made for the Bass Center in the early 90s and is extremely rare and collectable today. Anniversaries have meant special editions and Fender celebrated the Precision for the company's 50th anniversary in 1996 with a figured top, gold hardware edition Precision, and again in 2001 for 50 years of the Precision Bass itself. Two models were offered, one a 50th Anniversary American Series P-Bass with 1950s Butterscotch Blonde finish and black anodized pickguard, and the second a Custom Shop special 1951 Anniversary Precision Bass recreated to every last

detail of the original including phenolic bridge saddles, fibre dot inlays, solid slab ash body and chipboard case.

Players

To list influential players for the Fender Precision Bass would easily fill a book. Fender nominated hundreds for its Precision Bass 50th Anniversary celebrations. Many players are instantly associated with the P-Bass, including James Jamerson, John Entwistle (who boasted a Precision for every year of manufacture at one stage), Sting, Brian Wilson, Steve Harris, and Donald 'Duck' Dunn. That's soul, pop, rock, blues, and metal catered for. Other players made the Precision sound felt across the world with perhaps less credit than they deserve; Bill Black (bassist with Elvis Presley), Carol Kaye (one of the session players on the Beach Boys' later hits), Leland Sklar (US session legend), and many others included. In keeping with our modern Precision example, the P-Bass still cuts it today as the choice of Green Day's Mike Dirnt, Blink182's Mark Hoppus, The Deftones' Chi Cheng and Nick Oliveri, former bassist for Queens of the Stone Age.

VINTAGE CLASSIC: MUSIC MAN STINGRAY

History

When Leo Fender created the world's first solid body bass guitar in 1951, it ranked as an astonishing milestone in the history of bass. Amazingly, Fender managed to demonstrate his creative genius several more times, most notably with the Fender Jazz Bass and the Music Man StingRay. Although Leo Fender sold his company in 1965, the new owners, CBS, had placed a ten-year non-competition clause in his contract, so it came as no surprise when in 1975 Leo became involved with two ex-Fender employees, Tom Walker and Forrest White, who had recently formed the Music Man company. Notwithstanding his past achievements, Fender managed to create yet another all-new and superbly proportioned bass guitar. The StingRay featured active electronics as a first on a mass-produced bass, plus the unique three-above/one-below tuner arrangement. Despite featuring one single pickup, the StingRay became an instant classic and is still available in an upgraded format to this day. A twin pickup model, the Sabre, lasted until 1991 although it's fair to say it hasn't reached the cult-like status of the StingRay.

Leo Fender left Music Man in 1979 to form G&L Guitars with another ex-Fender man, George Fullerton. The StingRay continued pretty much unchanged until the takeover of Music Man by Ernie Ball in 1984. It continues to make the StingRay bass to this day.

Model range

Production began in 1976. The bass featured here is a classic example dating from early 1977. Few options were offered on the StingRay other than colour choices, with sunburst and natural proving the most popular, and a rosewood fingerboard instead of maple. Early basses can be identified by the three-screw neck plate (four-screw from 1980), and slab body design with through-neck stringing. Early, pre-Ernie Ball instruments definitely fall into the classic/collectable category these days and should be carefully checked over for authenticity.

Following the Ernie Ball takeover, the StingRay was gradually developed without losing

any of its huge character. Body contouring appeared, to prevent the bass digging into the player's ribcage, and soon the four-screw neck plate evolved into a rock solid six-screw affair. The bridge lost the adjustable mutes and the through-body stringing system but this wasn't missed by many players. New options appeared, including a three-band active EQ (which usefully sported centre detents) and most significantly, in 1988, a five-string model simply called the StingRay 5. The StingRay 5 came with three-band EQ as standard and featured a custom pickup with a hum-cancelling phantom coil allowing an extra three-way pickup selector to be fitted. Although the bass was still armed with just the classic single humbucker, the selector allowed the user to choose between single-coil mode, humbucking series, or humbucking parallel modes.

Still leading the Music Man line up, the StingRay has been brought into the new millennium with more colour choices, including custom sparkle finishes, matching painted headstocks and a choice of scratch plates. A piezo bridge or twin pickup option is also available, giving the StingRay huge amounts of tonal versatility.

Special models

Music Man created one special StingRay model in the early 1980s, known as the Cutlass. Essentially it was the same as the StingRay but featured a carbon graphite neck made by Modulus guitars for Music Man. A Cutlass II model featured twin pickups and was based on the Sabre model. Cutlass basses are extremely rare, with a premium price to match.

An even more exclusive beast is the NAMM 100th Anniversary StingRay bass. Ernie Ball produced just 100 of this model to celebrate a century of music trade fairs in the USA. Harking back to the original Cutlass model, the bass features a graphite neck, Inca Silver finish, three-band EQ, black pearl pickguard, and through-body stringing. A future collectable for sure.

Recently a limited-edition colour instrument series has been launched, although its only distinguishing features are its finishes, such as 2005's Butterscotch Cream, matching headstock, and vintage styled case. 2006 sees the 30th anniversary of the StingRay and a limited edition 30th Anniversary StingRay model with a mahogany body and translucent red will add to the growing number of collectable Music Man basses.

Players

The StingRay's influence can be seen and heard in the wide range of players to have embraced the model's cool vibe and huge tone, including Michael Anthony of Van Halen and Cliff Williams from AC/DC, both of whom used the StingRay's potent low-end to great effect.

Early funkmeisters such as Bernard Edwards of Chic, and Louis Johnson, who played with Michael Jackson on his *Thriller* album, laid down some seriously bad grooves on vinyl in the 1970s and 1980s on StingRay 4s. And the funk continued its Music Man connection when The Red Hot Chili Peppers' Flea embraced the StingRay as his punk-funk weapon of choice. Tony Levin crossed just about every musical boundary with his four-, five-, and three-, yes, *three*-string StingRay basses. Gail Ann Dorsey praised the StingRay for its versatility in a career ranging from Tears For Fears to David Bowie. Pino Palladino triggered a fretless frenzy after laying down a sinuous intro with his fretless StingRay on Paul Young's 'Wherever I Lay My Hat'. Even 'alternative' bands have picked up on the vibe

VINTAGE CLASSIC: MUSIC MAN STINGRAY

YEAR: 1977
BODY: Ash
COLOUR: Inca Silver
NECK: Maple, bolt-on
FINGERBOARD: Maple
PICKUP: Active Music Man humbucker
CONTROLS: Volume, bass, treble
SCALE LENGTH: 34" (864mm)
HARDWARE: Chrome

of the StingRay; our Inca Silver example formerly belonged to Colin Greenwood of Radiohead.

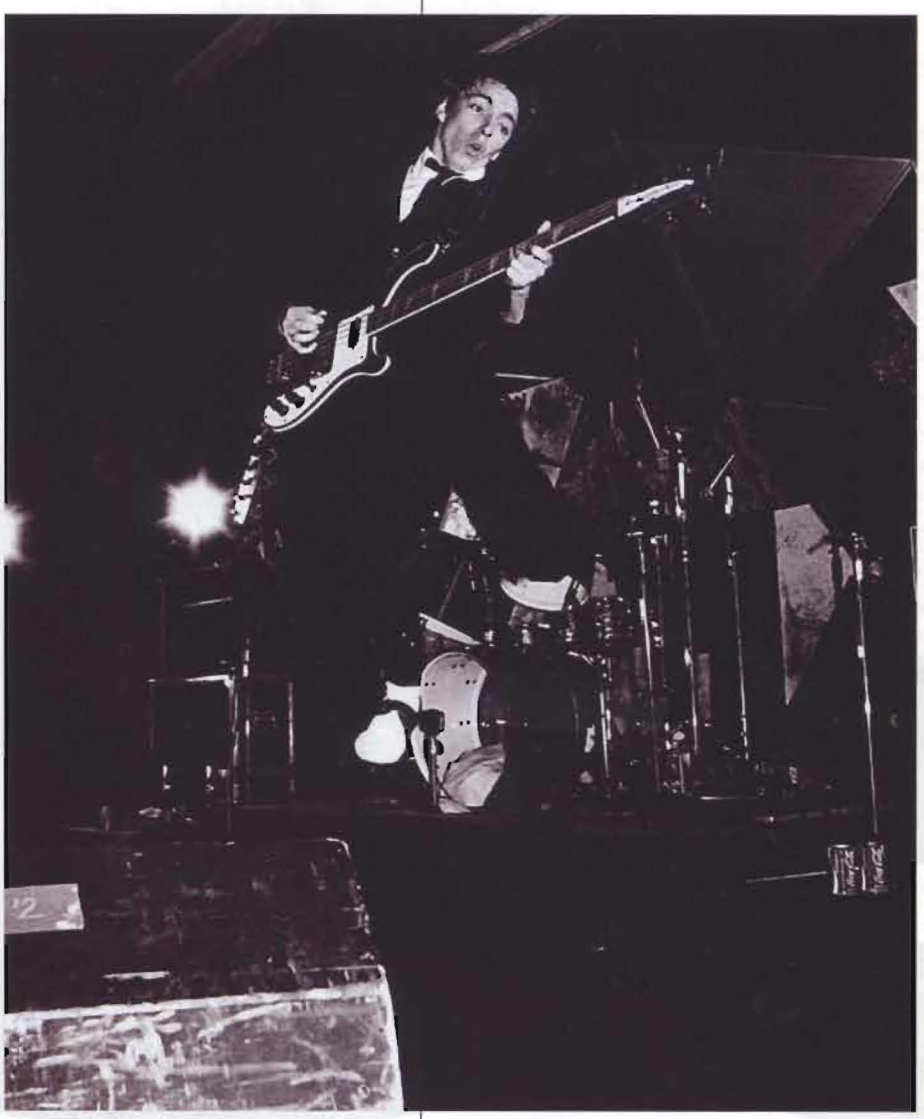
VINTAGE CLASSIC: RICKENBACKER 4001

History

Often credited with providing one of the very first electric basses, preceding even Leo's Precision bass, Rickenbacker certainly was creative in its first commercial bass guitar design. An even earlier bass, an amplified upright creation, sowed the seeds for the 4000 series, the range with which the company would become synonymous.

Founded by George Beauchamp and Adolph Rickenbacher, the company registered its patent for the 'Frying Pan' styled electric guitar on August 10th, 1937. After Beauchamp's death, Rickenbacher continued the company until selling to Francis Cary Hall in 1953. At the time, Hall was Fender's distributor, and the Rickenbacker purchase (the company soon adopted the commonly-known spelling of the company name rather than retaining Adolph's family version) soon spelt trouble for Fender and Hall's relationship. Hall cut his ties with Fender in 1955. In 1984, he transferred the Rickenbacker business to his son John C Hall, who continues to run the company to this day. Rickenbacker's fortunes were cemented when three Beatles began using their instruments: John Lennon with the 325 guitar, George Harrison with his 425, and Paul McCartney with the 4001 bass.

Bruce Foxton of The Jam in action with his Rickenbacker 4001.



Model range

The first variant, the single pickup 4000 model, sported a scale length of 33.5" (851mm), along with a through-neck construction, something unique at the time. The 4001 was a two-pickup variation of the 4000 and incorporated deluxe features such as body binding and triangle marker inlays. The unique 'horseshoe' pickup design was soon replaced by a more conventional one, albeit sporting the same look by means of a chrome cover. The 4001 enjoyed a

VINTAGE CLASSIC: RICKENBACKER 4001S

YEAR: 1964
BODY: Maple
COLOUR: Fireglow
NECK: Maple, through-neck
FINGERBOARD: Rosewood
PICKUPS: Two passive single coil
CONTROLS: Two volume, two tone
SCALE LENGTH: 33.5" (851mm)
HARDWARE: Chrome

production run from 1961 to 1986; even the single-pickup 4000 was available until 1984.

In 1979 the 4003 was launched, which, although visually similar to the 4001, was designed to accommodate the more popular roundwound strings. Two of Rickenbacker's most famous endorsees, Paul McCartney and Chris Squire, played a 'simplified' variant of the 4001, known as the 4001S. Normally only available as an import to the UK, where it was known as the Model 1999, the 4001S had dot markers on an unbound fingerboard and an unbound contoured body similar in style to the 4000 model. Signature bass models include the Chris Squire Limited Edition 4001CS, available in a 1,000-run edition with African vermillion headstock and fingerboard, special cream lacquer finish and Chris Squire signed scratchplate. Motorhead's Lemmy also enjoyed his own signature series 4001, with a carved front and star inlays. Fulfilling the needs of a retro hungry market, the 4001S has been reissued in several formats, firstly in the early 1980s as the 4001S and later as a more accurate 1963 period reissue bass, the 4001V63.

Players

Although produced in far fewer numbers than the Fender basses, Rickenbacker 4000 series instruments have acquired a loyal and dedicated fan base. The Beatles' revolutionary *Sgt Pepper's* album saw McCartney using his Rickenbacker 4001S for the first time, and he later followed his bandmates' example of psychedelic paint finishes for the *Magical Mystery Tour* album. Chris Squire's work with Yes had the same 4001S instrument right at the front of the mix, and subsequently progressive rock players have enjoyed the unique ringing treble tones of the 4000-series instrument. Geddy Lee of Rush, Michael Rutherford of Genesis and Marillion's Pete Trewavas all played Rickenbackers, often in challenging time signatures. Rutherford also played a rare, double-neck Rickenbacker with a bass and 12-string guitar. Incredibly, a 4000-series bass even found itself employed for funk duties when Cordell 'Boogie' Mosson insisted on using one for the recording of *America Eats Its Young* by Funkadelic.

Surprisingly, the punk/new wave movement took kindly to the bass, which was somewhat ironic in view of its declared dislike of the 'prog rock' era. The Jam's Bruce Foxton was a fan of the plectrum twang his 4001 gave out, while Adam and the Ants bassist Andrew Warren employed a 4001 for the recording of *Dirk Wears White Socks*. Today artists such as Robert Hardy from Franz Ferdinand use the classic 4000 series, maintaining its position as the alternative bass choice.

SIGNATURE BASS: STATUS BUZZARD BASS

Some bass guitars are branded as signature models, bearing the signature and features of an artist closely associated with a particular instrument. Originally rare, signature models are now widespread. Fender popularised the trend with its Custom Shop offerings that spawned the Marcus Miller Jazz Bass (based on his natural finish 1977 with active circuit), Mike Dirnt Precision Bass (a '51/'55 Precision Bass hybrid), Mark Hoppus Jazz Bass (Jazz Bass body with Precision pickup and neck), and many others.

Some instruments are production versions of the artist's bass and almost identical to it, for instance the Michael Manring Zon Hyperbass, Mark King Status King Bass, Nathan

SIGNATURE BASS: STATUS BUZZARD BASS

YEAR: 2003
BODY: Graphite
COLOUR: Black
NECK: Graphite through-neck
FINGERBOARD: Phenolic
PICKUP: Two Hyperactive soapbar
CONTROLS: Volume, pan-pot, bass, treble, mid frequency, LED switch, midrange switch
SCALE LENGTH: 34" (864mm)
HARDWARE: Chrome

East Yamaha BBNE, and the Billy Sheehan Yamaha Attitude Limited II bass. Others are based upon an artist's bass, and may not sport all the features of the original, but are usually much more affordable, such as Fender's Stu Hamm Urge Standard Bass (now discontinued). Lakland produces a range of signature basses largely based upon instruments used by session players such as Joe Osborn, Bob Glaub, Jerry Scheff, Donald 'Duck' Dunn, and Rolling Stones bassist Darryl Jones.

Alembic produces two signature basses reflecting pioneers of slap bass across two countries, Mark King in the UK and Stanley Clarke in the US. The Stanley Clarke model is unusual in sporting a shorter 30.75" (781mm) scale length, but it reflects the player's requirements and is therefore an accurate signature bass. Some players have signature instruments made by more than one manufacturer. Mark King of Level 42 also had a very limited edition Fender Deluxe Jazz Bass produced in the UK, featuring LEDs in the fingerboard and a chrome plated battery cover with engraved signature and production number, which was limited to (of course) 42 pieces. John Entwistle's original Buzzard bass was made by German manufacturer Warwick, but his frustrations at the instability of the wooden neck soon led to a development using Modulus graphite necks, until a partnership with Rob Green from Status led to an all graphite instrument as seen here. Warwick also re-issued the original wooden Buzzard bass in 2003.

Steve Bailey has a signature Aria bass based upon his six-string fretless. Thankfully, fretted and four-string versions are also available. US artist Jeff Berlin has a Dean signature bass sporting his favourite two pieces of hardware, the Badass bridge and Bartolini pickups. He previously chose to not add his name to the Peavey Palladium model, which was in effect his signature bass. Cort's elaborately painted T.M. Stevens Funk Machine also features built in wah effects, fine tuned by inboard controls, and activated by an external on-off switch. It also produces a signature acoustic bass for Mark Egan, something Fender also offers in the Victor Bailey model. Even more exotic is the seven-string Bill Dickens GT-BD7 signature bass offered by Conklin. Flea, champion of the Music Man StingRay bass for many years, finally found a signature series bass with Modulus, which produces the Modulus Flea Bass complete with graphite neck and vivid metallic flake finish.

MULTI-STRING BASS: HAMER B12S 12-STRING

In 1980, Hamer launched this 12-string bass; four courses with three strings per course, one fundamental and two octave strings. It demanded a great deal of physical effort to play, although the resulting sound approaches a cross between the sound of thunder and barbed wire being dragged across a blackboard.

The idea of employing more than four string.s with the aim of enhancing what the four-string already offers, as opposed to extending the range of the instrument, was in fact a very early bass breakthrough. Swedish manufacturer Hagstrom released its H8 model in 1967 and was an early pioneer of the multi-string bass. It found its way into the hands of Jimi Hendrix very quickly; just have a listen to 'All Along the Watchtower'. The eight-string employs four 'courses' (EADG), but each course sports a second string an octave higher. Wound strings are used for the extra octave string from E to D and a plain string for the G, owing to the high range of the note produced. Many companies

MULTI-STRING BASS: HAMER B12S 12-STRING

YEAR: 1980
BODY: Maple
COLOUR: Cherry Transparent
NECK: Maple, set-neck
FINGERBOARD: Rosewood
PICKUP: Two EMG humbuckers
CONTROLS: Volume, pan-pot, EXB tone (active)
SCALE LENGTH: 30.5" (775mm)
HARDWARE: Chrome

offered an eight-string model after Hagstrom, including Rickenbacker with its 4008, an eight-string version of the 4001 bass. The Ibanez Musician bass gained a lot of exposure after Sting played a fretless example during his time with The Police. Less well known is the eight-string variant launched in 1979, the snappily titled Musician MC980, which sported an ash and mahogany body, ebony fingerboard, 32" (813mm) scale length and through-neck construction. Many makers both large and small have added multi-string instruments to the options list. Of notable merit is Pedulla's eight-string fretless the Octabuzz. Try playing that in tune...

Players

Those who have made multi-string their chosen instrument often find it hard to live without, such is its presence. Tom Petersson from Cheap Trick used the Hamer 12 both live and in the studio and now uses a Chandler Royale 12-string. Doug Pinnick uses the Hamer 12 with King's-X. Its majestic sound is heard to great effect on *Gretchen Goes To Nebraska*. The Cocteau Twins' Simon Raymonde employed an Ibanez MC980 as his first bass with the band, writing the lush tune 'Millimillenary' on its first outing. Led Zeppelin's John Paul Jones used an eight-string made by Alembic during the band's final stadium shows, and now employs custom Manson multi-string instruments including a 12-string using six courses, each with a fundamental and an octave string.

AMAZING BASS: WASHBURN BOOTSY COLLINS SPACE BASS

Bass guitars haven't always been conservative workhorses. Every now and then someone wants to break out of the mould and produce something extraordinary. For instance, our featured instrument: the Washburn Bootsy Collins Space Bass. Bootsy Collins has kept the funk alive for artists such as James Brown, Parliament, Funkadelic and his very own Rubber Band. Although he originally laid down his grooves on a Fender Jazz, the psychedelic rock of his P-Funk years (incorporating all his various band projects) led to the Space Bass, originally designed and built by Larry Pless. Body styles are limited by the imagination of the designer and the attitudes of the buying public. Parker's Fly Bass not only has a futuristic shape, it employs such modern touches as a thin, ultra light multi-ply body, piezo-equipped bridge, and contouring achieved by curving the entire body.

Removing the headstock of a bass seemed a silly idea until furniture designer Ned Steinberger, working from a New York wood work cooperative with Stuart Spector, incorporated a headless neck into a bodyless design with his Steinberger L2 in 1979. With barely a nod to convention, other than the presence of four strings, the all-composite 'cricket bat' bass was presented to the public, who weren't sure whether to laugh or cry. But as happened with the original Fender Precision, it only took a few brave souls to show that this bass could work and soon everyone followed suit. Status employed headless designs with full-size normal bodies to give the advantage of headstock free design (balance, finer tuning ratios and reduced length) but the visual appeal of a normal body. Hohner soon began making licensed copies of the original at lower prices.

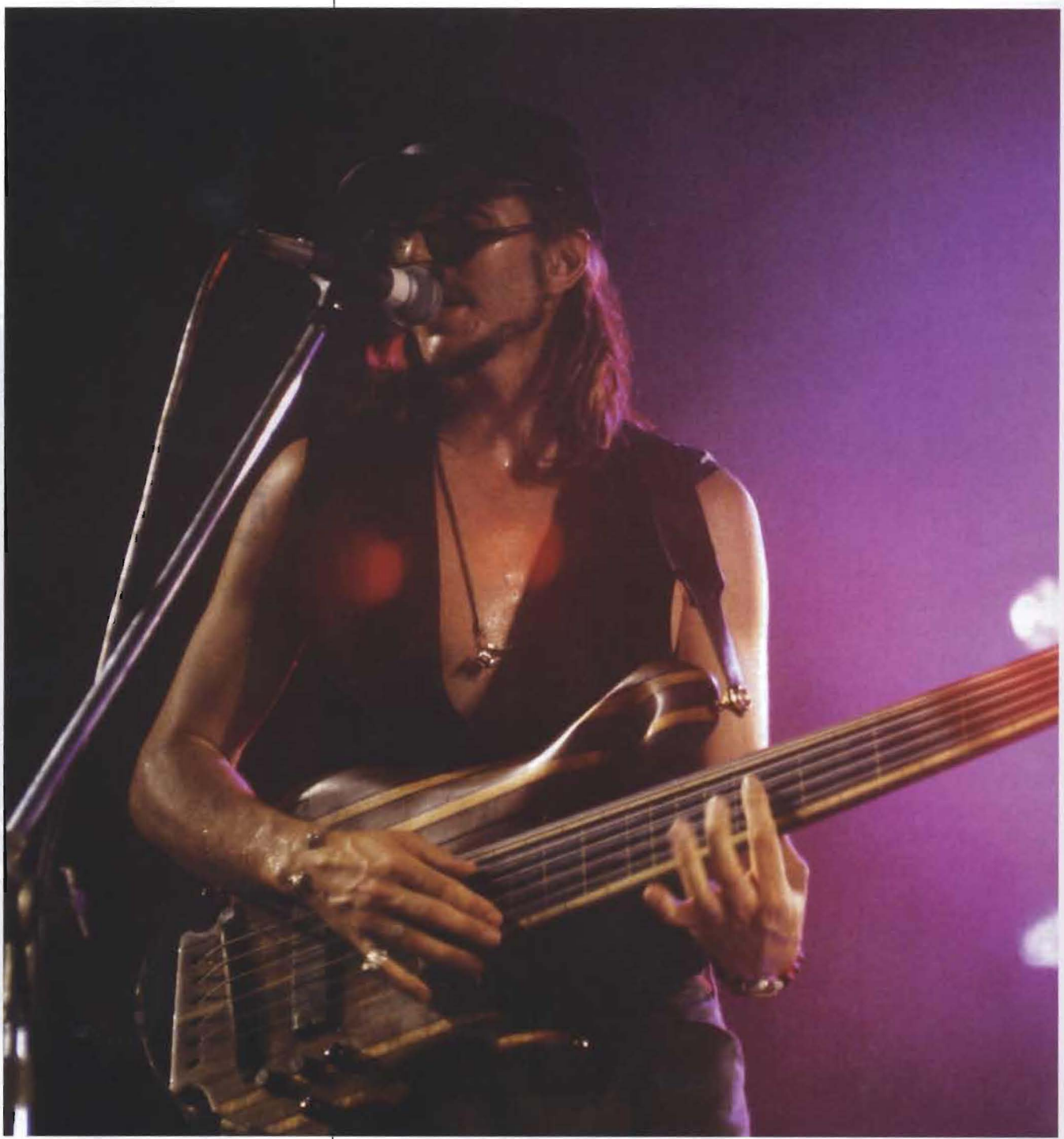
Even more unusual designs emerged after Ned's original, none more so than the

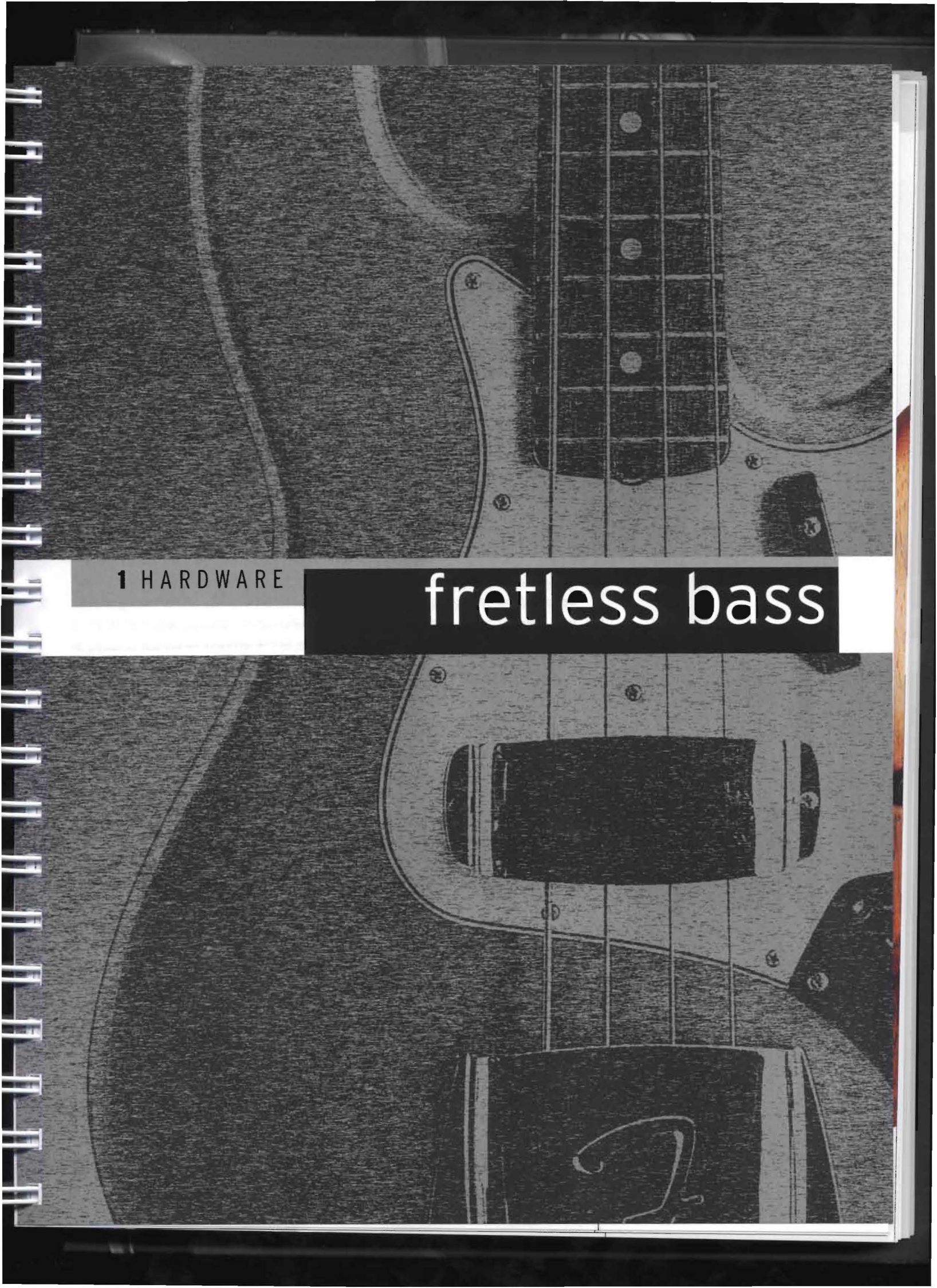
AMAZING BASS: WASHBURN BOOTSY COLLINS SPACE BASS

YEAR: 2005
BODY: Mahogany with maple cap
COLOUR: White
NECK: Maple, through-neck
FINGERBOARD: Birds-eye maple with star inlays
PICKUP: Two STKJ2 Seymour Duncan
CONTROLS: Two volume, two tone
SCALE LENGTH: 34" (864mm)
HARDWARE: Gold

Westone Rail bass, which removed even more material from what was left of the minimalist body, substituting two rails that secured a sliding pickup and electronics unit.

Carl Thompson basses, a favourite of wacky bassist Les Claypool (he is playing one, below), are noted for their ornate scroll designs and multi-laminate bodies. A perfect bass for the music of Claypool's band Primus.





1 HARDWARE

fretless bass

Most bass players, at the very least, consider playing fretless bass. Others take it further with a purchase, more often than not as a second bass. "I'll just use a bit of fretless for this track," seems to be the line of thought. And then there are the true fretless players who embrace fretless bass as an instrument in its own right. A fretted bass is their second instrument.

FRETLESS HISTORY

OPPOSITE: the first fretless bass, the Ampeg AUB-1, launched in 1966.

The true origins of this slinky, somewhat leftfield beast are shrouded in uncertainty. Legend has it that the instrument was the invention of bass pioneer Jaco Pastorius. Always an innovator, Jaco had honed his chops to impressive, if not yet mind-blowing, levels when he purchased a 1962 Fender Jazz to use in South Florida club gigs and teaching sessions. In 1969 or 1970, the story goes, he decided to try for a new sound and removed the frets, probably with a pair of pliers, before painting the grooves and the fretboard with a layer (or more likely, multiple layers) of marine epoxy, the super-tough varnish used to coat the hulls of boats. Using the hard surface to produce his trademark 'singing' fretless sound, Jaco was soon crediting himself as the inventor of the electric fretless bass guitar. But was he? Intriguingly, it seems that no one actually knows for a fact when the first electric bass was actually defretted. However, the most likely theory is that the earliest fretless player to receive widespread attention was Bill Wyman of The Rolling Stones, who played a home-made fretless as early as 1961, when Pastorius was only 10 years old. It began life as a standard fretted instrument, as the laconic four-stringer revealed in an interview some years ago. "I was playing in a rhythm and blues band in 1961 when I bought [the bass] from this bloke our drummer knew. Before that I'd been playing bass on the bottom two strings of a detuned guitar, so I was glad to finally have a 'real' bass. Unfortunately, it was bloody horrible! It rattled with every note because the frets were so worn. I figured I'd just pull out all the frets and put in new ones when I could afford some. But when I pulled 'em out, it suddenly sounded really good! So I never put frets back in, and I think it was the first fretless electric ever. I used it on every Stones album and many of the singles up to 1975. Even without an amp, it sounds wonderful – it's got the sound."

A few years passed before the fretless bass gained much commercial currency, but the profile of the instrument received a boost in 1965 when Ampeg, the company known nowadays for amps rather than instruments, began to produce a production-line fretless, the AUB-1 (or Aubi). Shortly afterwards, respected players such as Rick Danko (of The Band), Dan 'Freebo' Friedberg (Bonnie Raitt) and Rand Forbes (The United States Of America) were seen playing fretless instruments. James Brown's bass player, Bernard Odum (whom Jaco cited as an influence), can also claim to have been at the vanguard of the new style.

But perhaps the search for the very first fretless player is futile. After all, it was certainly Pastorius who popularised the fretless bass, even if he didn't invent it. And the man himself may have been playing word games when he told BBC interviewer Clive Williamson, in 1978, "So I'm the first guy to be using a fretless, is actually what it boils down to, and then more, because I'm the first to really get down and play it, because

other guys cannot play it in tune, y'know?" Did he mean that he was the first player to play the fretless accurately, rather than being the very first player of all? We will never know. But we can listen and marvel to his early playing, and enjoy his honesty. This was, let us not forget, a man who used to dip his fingers in fried-chicken grease before performing to give his playing an added dexterous touch.

However it developed, the instrument we are left with is a unique creature. No other machine can produce sounds which are so often described as 'singing', 'purring', 'humming', and 'ringing'. But this array of mellifluous notes doesn't come cheaply: even those who have mastered the fretless to moderate levels of proficiency have been obliged to spend many hundreds of hours on techniques which fretted-bass players either take for granted or simply do not require. For example, one of Jaco's most frequently-repeated assertions was that a fretless player needs to 'feel' as much as 'hear' the sound he or she is making. This is a matter of sensing the frequency of the note as much as simply noticing it, which is an approach that requires subtlety and self-awareness. It's perhaps for this reason that the fretless is regarded as more sensuous, and even more feminine, than its fretted counterpart.

Another obvious difference between fretted and fretless approaches is, of course, that the player can slide between notes – or chords – far more smoothly and accurately than if frets were in the way, forcing the note to drop by a tone or semitone every time the fretting fingers slide past a fret. Gliding at an even speed down the neck requires accuracy – and seasoned players will often refer to 'caressing' the notes from the bass for this reason. Considerable technique – and control over the degree of pressure – is also essential: a successful glissando is most likely to occur, for example, if the bassist has managed to maintain absolutely equal finger pressure against the neck from origin to destination. This applies to harmonics too: trapping one or more against the neck immediately after the string is plucked, and sliding one or more up or down, is a great way to add texture to a phrase. Its widespread use in the 1980s led session bassist John Giblin to declare, "I hate hearing that now, even though I still do it occasionally! Ron Carter was the first person I heard doing that, on an upright bass."

So much for the instructions. But where can we go to hear fretless brilliance in action? Apart from Pastorius and the aforementioned pioneers, the fretless apprentice should spend some time studying the fearsome skills of Jack Bruce, who in recent years has switched over almost exclusively to fretless. Famously a devotee of the Warwick Thumb bass (whose body he helped its makers to redesign a few years ago), it's perhaps no surprise that the ex-Cream member started his life in the four-string world as a double bass player. Asked recently why he plucks the strings with such force, he replied: "[I use] double bass techniques and I still play that way, even on fretless. It's a bit peculiar, but it also comes from playing a vina, which is a classical Indian instrument. I studied that in the 1960s, and have actually started studying it again ... I thought I had kind of a unique thing, but when I met James Jamerson, I discovered that he was known as 'the hook', because he also used mostly his index finger, but of course you use your second and third fingers on occasion. But he was interested in this vina technique I'd developed for playing very fast passages... Having been a double-bass player is an obvious asset."

Another familiar fretless figure is the renowned session player Pino Palladino, who started his musical career as a classical guitarist but switched to bass at the age of 17. It only took him a year before he decided to move to fretless, and by his early 20s he was playing in funk and R&B bands. This led to a gig with The Millionaires, former Squeeze keyboard player Jools Holland's band. That in turn brought him to the attention of early-1980s pop and electro stars such as Gary Numan and Paul Young. In 1983 the latter recorded the song for which Pino will always remain most well-known: a cover of Marvin Gaye's 1963 hit 'Wherever I Lay My Hat'. Palladino opened the song with an ethereal, melodic bass part that perfectly underpinned Young's soulful vocal, without the need for percussion or other accompaniment until a whole intro, verse and chorus had passed. Later in the song, Pino can be heard introducing a subtle slap and pop, as well as a few medium-register fills, while managing to maintain the groove with perfect awareness. All aspiring fretless players should study this bassline: the fact that Palladino was asked to step into the considerable boots of the late John Entwistle just before a Who tour in 2002 speaks volumes.

More contemporary than Bruce and less fêted than Palladino is Gordon 'Sting' Sumner, whose phenomenal success as a singer, songwriter, campaigner, and media figure tends to obscure his awe-inspiring talents on the fretless. Inevitably, his early recordings as frontman with The Police were plagued by the twin demons of the 1980s post-punk bass player – a churning chorus pedal and an obsession with reggae basslines. However, the genius behind the spiralling, super-economical bass parts in 'Walking On The Moon' (forever Sting's best-known bass riff) and 'Message In A Bottle' (in which, at points, only his succinct playing and a rimshot keep the song rolling) is evident for all to see. His finest moment? Perhaps 'Spirits In The Material World', where the repeated bass motif running through the verse is made up of a slippery cluster of sixteenths and an expertly unselfish rest. Although many of The Police's recordings were done on fretted bass, for live work Sting used a 1979 Ibanez Musician fretless bass, and he later went on to experiment with electric upright. Always ready for a challenge, Sting famously tried his first fretless on the same day he decided to use it on a gig, making the point that if you hit a 'bad' note it's OK so long as you keep a straight face. Wise words indeed. Later he used the simple but effective trick of doubling an electric or acoustic upright with fretted bass, starting with the Van Zalinge Z-Bass he purchased during the making of Zenyatta Mondatta. Check out 'Don't Stand So Close To Me' as an example.

Perhaps the most memorable fretless player of recent times is Primus frontman Les Claypool, whose almost unearthly playing skills provide his band with all the funk, metal, jazz, and rock licks they can take, and more. One of the few players to master tapping, slapping, and even tremolo-powered dive-bombing on a bass – and a fretless bass at that – Claypool honed his style by listening to Stanley Clarke and Larry Graham. Equally fond of heavy metal (he famously failed the audition for Cliff Burton's spot in Metallica for being too flash), he regularly namechecks Rush bassist Geddy Lee as his greatest influence. This goes as far as attaching a bit of wood with Lee's signature on it to the headstock of the bizarre instrument he uses, a Carl Thompson creation called the Rainbow Bass. Made of strips of walnut, curly maple, padauk, purple heart, ebony and cocobolo, glued in a vertical stripe pattern, the Rainbow comes in several configurations

ABOVE: Sting, playing an Ibanez Roadstar II RB999 fretless.
OPPOSITE: Pino Palladino's 1979 Music Man StingRay fretless.

including four- and six-string fretted and fretless, and stands out from the crowd thanks to the weird, muscular wooden scroll which functions as its top horn.

UK bassists such as Pino Palladino, Jack Bruce, Mick Karn, Percy Jones, and John Giblin are artists who have tended to find their own unorthodox approach to fretless. The US market in contrast has produced a number of schooled and highly proficient technicians who leave jaws on the floor with the sheer brilliance of their playing. Representing the cutting edge of fretless bass are players such as Steve Bailey, who used a six-string fretless with artists as diverse as Dizzy Gillespie and Jethro Tull. His technique employs stacked fifth interval leaps, the use of distortion and harmonics, and a sense of humour that somehow could only come from a fretless player. Michael Manring uses fretless (a Zon Hyperbass covering three octaves on four strings) as an avenue for exploring the limits of fretless solo bass, and many others have trodden this path, where improvisation seems to be even freer without the confines of fretwork. Bassist Gary Willis looks at bass playing and the role of the bassist in a most refreshing manner, eschewing conventional wisdom if it doesn't produce the results required, as his custom tuning peg, 'ramp', and fretboard ideas have proven. Such analytical methods have allowed the bassist to sit as a sideman to Wayne Shorter, Allan Holdsworth, Robben Ford, and Dennis Chambers as well as providing a distinctive fretless voice to Tribal Tech, his own band with Scott Henderson.

So where does all this leave us? Maybe with the knowledge that the fretless bass is

THIS PAGE: a Tune WB-4 fretless bass, which features piezo-electric pickups for a 'wood bass' sound.
OPPOSITE PAGE: a Fender Precision fretless from 1973.

as weird and wonderful as anything in the world of its fretted counterpart. There are more lovers of the fretless out there than you think – and they, like Bruce, Palladino, Sting and Claypool, know what rewards are to be had from playing the instrument. Remember – with a little courage and application, the nightmare of fret-loss need never disturb your sleep. Just keep the chicken grease handy.

GET THE GROWL

Finding a signature sound on electric bass is a life-long challenge. Few players reach that goal and of those who do, many find their bass voice on the fretless. There is no real secret to finding the right fretless bass other than a lot of seeking out gear and experimenting. Players do tend to fall into two distinct camps; those seeking an upright-like tone and those favouring a more modern growl. But why follow fashion? You can always discover your own unique fretless sound. I've played dozens of fretless basses in the last 20 years and each has its own vibe and soul. One route that many players have taken to try and discover the joys of fretless playing is that very same route that Jaco took; the DIY (or alternatively the paid professional) approach of ripping out (or carefully removing, for our repair man) the frets of a fretted bass and replacing them with filler to provide a cost effective fretless experience. A word of warning; de-fretting a bad bass does not turn it into a good one. For every successful de-fret existing, I have seen and heard a poor one. Consider this option very carefully, and under no circumstances attempt it on a vintage or collectable instrument, as it will ruin its value. Bill Wyman, however, did get lucky on his transformation. And as for Jaco, he would have ripped the frets out of any instrument and made it sound amazing.

So, just what is it that contributes to a great fretless sound? More importantly, just what is a great fretless sound? For many, it's the way a note swells and blooms outwards after the initial attack. Then there's the growl. Not a hard midrange growl, but a harmonic- saturated low-mid that adds to that swell we've just mentioned. And finally we need some warmth. That slightly lo-fi, rounded, double bass-like bottom-end that kicks out more natural warmth than a log fire. Just think 'Donna Lee' from Jaco's debut album and you're there.

Taking the player out of the equation, we are left with the neck, fingerboard, body, strings and pickups as the main ingredients for achieving fretless heaven. So where should one look? Stefen Manz from Warwick suggests you analyse what sound you are looking for first: vintage upright or modern growl. "The sound depends on the demands of the player. In general, for the neck I prefer a hard wood, like ovangkol, which is what we use on most of our basses. The hard neck gives a better focus to the tone and due to its hardness it vibrates less and increases the sustain. For the body wood, it depends on what a fretless player is looking for. A vintage-like, high-mid focused tone can be achieved with a body from soft or medium-hard woods such as ash or maple, while for a round, rich tone with a tighter bottom, a body of hardwood, like bubinga or afzelia, is better. Ovangkol sits in the middle of both."

Pete 'The Fish' Stevens from Electric Wood, who builds the Wal basses that Mick Karn, Geddy Lee, and many others refuse to part with, also favours a slightly exotic wood finish, as US distributor Steve Chesney explained. "In terms of fretless, Wal likes to use American walnut with a natural finish for wood facings. It seems to offer a tonal quality that is consistently warm and natural. Ebony would be the wood of choice for the fingerboard. It is much harder than rosewood, so it can stand the abuse of fretless playing on a daily basis."

The ebony fingerboard approach seems to be fairly consistently echoed among bass builders. Fretless specialist John Giblin, whose fretless bass sounds have graced albums by Kate Bush (try 'Babooshka' from *Never For Ever*) and Peter Gabriel, is a firm believer in ebony, to the point that he had one of his Fender basses converted to fretless by replacing the entire fingerboard with one taken from a 100-year old upright bass.

And of course there's always the approach favoured by Pastorius, which unsurprisingly Fender uses as its mantra: "We use an alder body, maple neck, and rosewood fingerboard... just like Jaco's!"

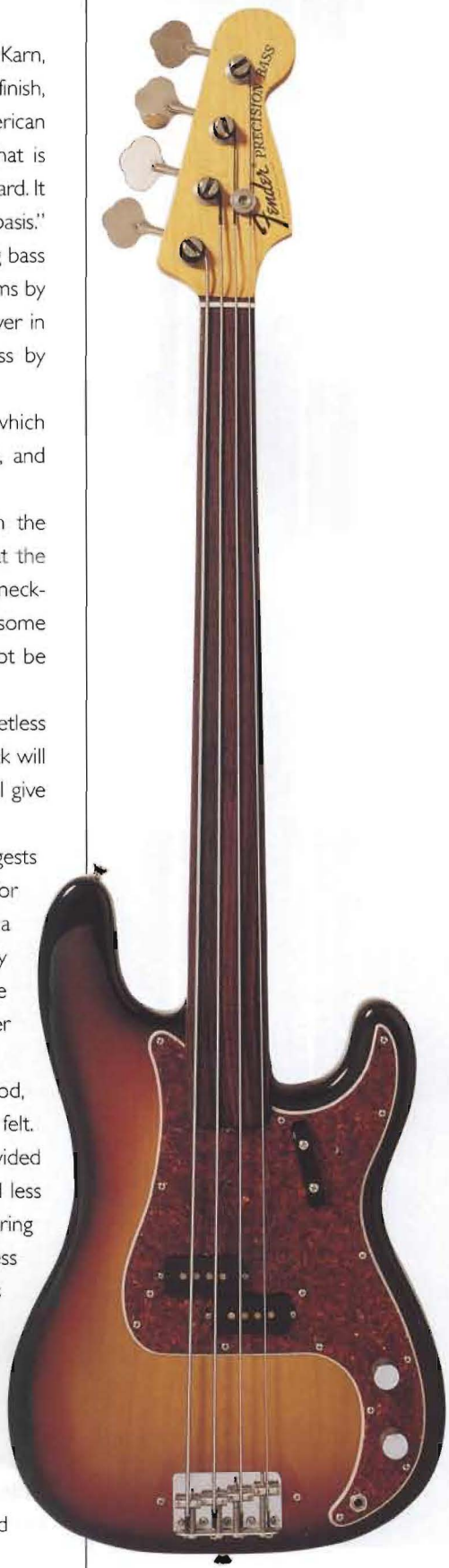
But what's the best way to send the message from the fingertips, through the fingerboard and into the pickups; a through-neck or a bolt-on? Chesney feels that the through-neck offers few advantages. "Wal doesn't see a great deal of advantage to neck-through versus bolt-on necks. Neck-through may offer a slight increase in sustain in some cases, but if the neck joint on a bolt-on is tight and solid, the difference would not be discernable."

Fender feels that it still depends on the player despite offering virtually all its fretless models as bolt-ons: "It's definitely a question of personal preference. A through-neck will offer more of a smooth, mid-biased tone with more sustain whereas a bolt-on will give more attack and punch, allowing the bass to cut through more."

Whilst emphasizing that it still depends on the player's demands, Warwick suggests the following as a guide to the sonic differences. "In general, it's the same rules as for a fretted bass. While a bolt-on gives a stronger attack, the neck-through offers a slightly longer sustain with more bottom. A neck-through bass reacts more evenly regarding the volume all over the fingerboard, while on a bolt-on you can notice more clearly which note is played on the lower strings in upper areas, or with higher strings in the lower area."

With our wooden bodies vibrating, and our necks growling, whether wood, graphite or epoxy-coated, it's time for the humble string to make its presence felt. Surprisingly, this is an area where all manufacturers have strong but somewhat divided opinions. I have always favoured the nickel roundwound for its warmer sound and less damaging effect on the fingerboard. Electric Wood also favours the roundwound string but emphasizes customer preference. "Wal uses roundwound strings on its fretless basses, unless the customer requests half or flatwounds. Despite many fretless players choosing flatwound strings, Wal believes that roundwounds still offer a brightness and clarity that is purposely absent from flatwounds. Of course, this is all very subjective. The type of strings that should be used is dependent on the player's preferences. In the end, it is what is best for the customer and his/her playing style and needs."

Stefen Manz agrees on the player preference idea but favours stainless steel for Warwick's fretless models. "Roundwounds sound best for modern fretless tones and



for fretless I would suggest stainless steel better than nickels. Flatwounds are good for double-bass-like tones."

And Fender also offers further choice with its tapewound strings. "We suggest either Fender 9050 stainless steel flatwounds – these are very versatile and add a definite double bass tonality to your sound. Alternatively, Fender Nylon 9120 tapewounds – these are very soft and smooth and won't damage the fretboard. Tonally, they're round and warm."

This just leaves the pickups before we reach our amps for final tonal control. There's no hard and fast rule for an ideal fretless pickup, and players have been successful with just about every pickup combination available. To try and get close to Jaco's tone, a passive set-up of two Jazz Bass pickups works very well. The back pickup offers a nice bright response that lets harmonics leap out of the instrument, leaving the neck position to recreate warm upright-like sounds. And companies such as Warwick and Lakland use a combination of the Music Man-style humbucker in the bridge with a Jazz-style neck pickup for even more grunt and growl.

Michael Pedulla discusses pickup combinations in the 'Pedulla Bass-ics Guide' on his company's website. "The PJ, to our ears, is the best way to reproduce what the strings and wood of the instrument are doing acoustically. The 'P' has a tight midrange growl and combines very well with the upper mids of the 'J' pickup. With a full-range, flat frequency response, the PJ set-up allows you to tailor sound through careful selection of amplifier, cabinet and EQ." Using custom Bartolini circuits and pickups, the JJ combination is described as offering "... more low-end with just the front pickup and more upper midrange with both". I must have liked that description as I opted for it on my own bass, but what about those humbuckers? The guide suggests, "This configuration packs a lot of low-end bite, a full midrange and a very bright high-end."

Amazingly, one manufacturer has shown the ultimate dedication to fretless bass with a signature series fretless bass pickup and active circuit. Developed in conjunction with fretless supremo Steve Bailey, the Steve Bailey Fundamental Fretless Pickup And Tone Circuit System by Basslines, the bass division of Seymour Duncan, features a focused EQ, together with a switch that engages a frequency contour optimized to bring out fretless harmonics as well as mid-range boost. Here's what Bailey had to say about his pickup system when quizzed by Seymour Duncan staff. "When we designed these pickups, one of our goals was to have all the controls 'flat' and that be the benchmark of what I consider to be a nice, warm, 'jazz-bassy' fretless tone. Then one can add mids for even more punch, or more bass to go more 'Precisiony'. And, when I pull up on the top knob over the stacked bass control, the upper mids into the range of my artificial and natural harmonics get a good kick! I have also used this system in a fretted bass with great results. To me it is a simple system that is dynamic across the complete frequency spectrum."

Clearly, fretless heaven is rarely a case of just "ripping the frets out" of your bass guitar.

FRETLESS BASS: THE WARWICK THUMB

Now it's time to turn to fretless hardware. Whilst simply pulling the frets out of a bass worked for Jaco, rarely are such DIY conversions praised by the specialist luthiers of fretless bass. This **Warwick Thumb** model for instance bears many hallmarks that appeal to fretless players; a hardwood fingerboard (ebony is a common choice as well), pickup

FRETLESS BASS: WARWICK THUMB

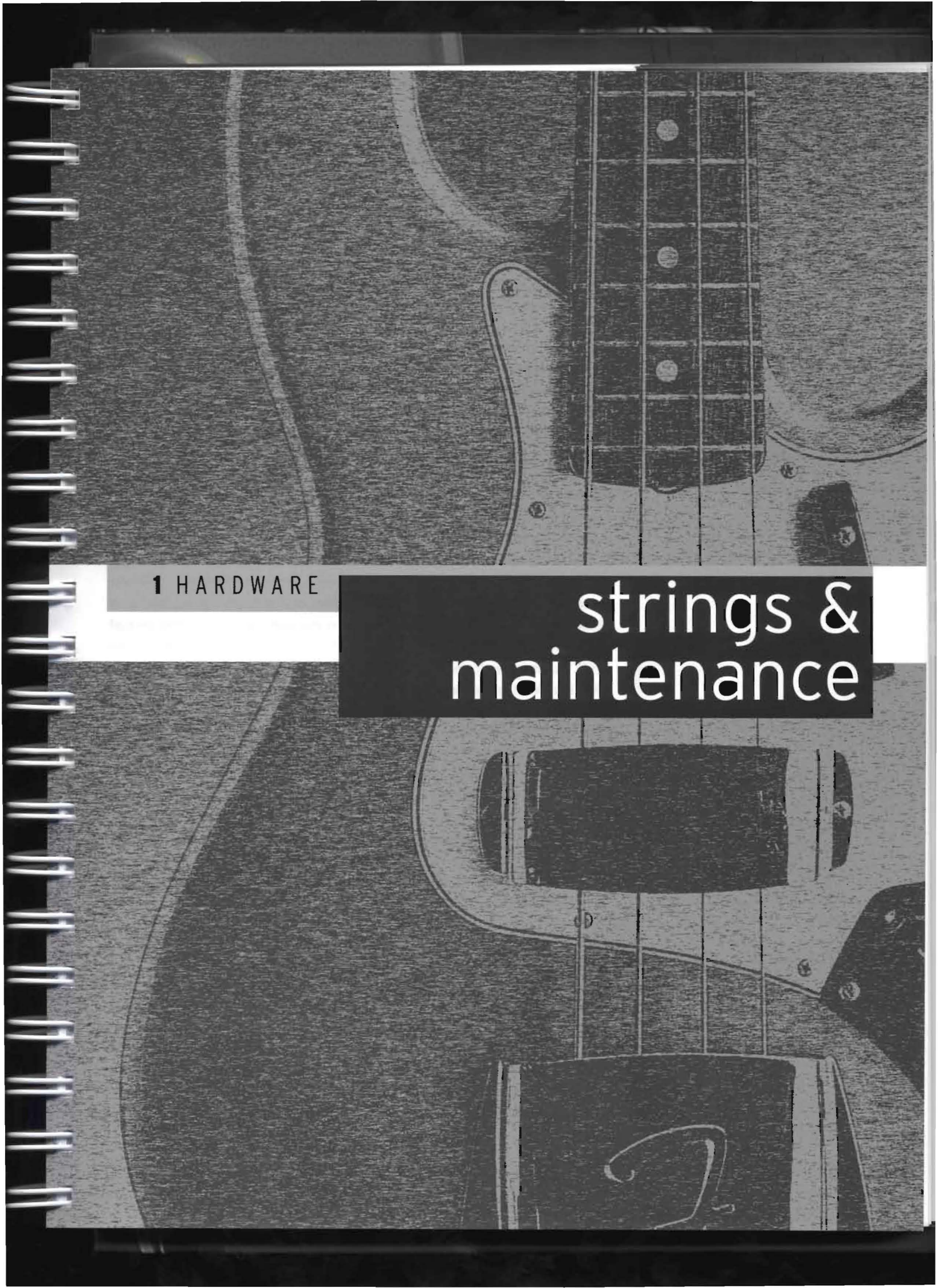
YEAR: 1993
BODY: Bubinga
COLOUR: Natural
NECK: Wenge/Bubinga through-neck
FINGERBOARD: Wenge
PICKUP: Two MEC J
CONTROLS: Volume, pan-pot, bass, treble
SCALE LENGTH: 34" (864mm)
HARDWARE: Black

positions that emphasize the growl aspect of the instrument, and a through-neck construction to emphasize sustain. Although Pastorius popularized the fretless bass with his adventures in spontaneous harmonic delight, Fender was somewhat slow to latch onto this potential market. Its first attempt preceded Jaco's popularity by about six years but it was the Precision bass that was chosen to sport a defretted fingerboard in 1970, thereby undoing Leo Fender's Precision moniker in the act of deliberate fret removal. Even more unusual was the choice of a maple fretless board, an option rarely exercised or even offered today.

Pedulla has sought to capture the tone of Jaco's bass by coating its Buzz bass's fingerboard in a hard, glass-like epoxy finish. A super low action designed to let the string buzz (hence the name) against this surface gives the instrument a rasping characterful sound. Wal basses have also been closely associated with a number of great fretless players; Mick Karn, Percy Jones, Laurence Cottle and Jonas Hellborg have stamped their own unique identities on a variety of Wal instruments. Hellborg opted for a Wal double neck with both fretted and fretless necks, something he used to great effect on his solo albums and live performances. Other players better known for their rock performances on fretted bass have also sung the praises of Wal fretless instruments, such as Jeff Ament from Pearl Jam. Not all fretless basses however fall into the high-end market. Nearly every bass manufacturer offers fretless varieties of at least some of their lower priced instruments. A fretless round-up in the UK's *Bass Guitar Magazine* saw the Yamaha BB404F, Vintage V940, Aria MAB-09, and Warwick Streamer RockBass go head to head in a fretless shoot out. The price ceiling was just £350 ($615) and the eventual winner, the Yamaha, was a bargain-like £299 ($525).

Lined fretless instruments lack the super cool look of an unlined fretless bass but they do allow an easier transition from fretted bass. Most makers offer a lined option in their catalogue and some budget models feature these "cheat marks" as well (see Yamaha BB404F above). Even Sting could be seen with small overhang lines on his Ibanez MC 924 Musician Fretless when he went fretless with The Police.

The Canadian built F Bass Alain Caron Fretless 6 bears the signature of fretless supremo Alain Caron, a 28 'fret' neck and hollow chambers to enhance the acoustic qualities of the instrument. UK luthier Overwater takes the hollow concept even further with its new fretless version of the semi-acoustic Expression bass that has all the features of an acoustic instrument – wooden bridge, deep hollow body soundhole – in a design that is more streamlined and contoured than that of conventional acoustic bass guitars.



1 HARDWARE

strings & maintenance

To get the most from your bass, you need to set it up and maintain it properly. But before that you need to make an important choice: which strings should I use? This decision has a significant bearing on the sound we produce, yet most of us give it a passing thought at best. Usually we just use the easiest or cheapest to obtain, or fall into the "name players use them so I will" temptation at purchase time. Yet most of us could improve our sound dramatically by spending a little more time considering our choice of strings. After all, they are responsible for producing the vibrations that the audience eventually hears. For many bassists it's not even a case of deciding which brand of string to choose; the whole daunting concept of gauges, materials and types of strings leaves many of us afraid to visit our local music store in case they ask some of those awkward questions. After all, with prices hitting as much as £50 per set, it's not really a buying decision you want to get wrong.

STRING HISTORY

Back in the 1950s, Leo Fender had to produce his own strings for his new breed of electric bass. These were originally upright gut strings wrapped with iron wire, which mimicked the flatwound strings used on upright basses. The importance of a good bass string is still prioritised by the inventors of the mass produced electric bass, as Fender Europe stresses: "Apart from the bass and amp themselves, strings are the most important element in creating a desired tone. It is vital to choose the ones that are right for you in terms of tone, weight and balance." As musical styles evolved through the 1960s, bassists began to require a different, more upfront tone from their instruments, which increased the popularity of companies such as Rotosound, who developed the first roundwound strings. Early adopters, such as John Entwistle, immediately saw the benefits from using roundwound strings, with their brighter clearer tone, and pushed the bass guitar higher in the mix. Suddenly bass players weren't just responsible for audible thuds; they could also go 'twang'! The importance of James How's roundwound string design really can't be overlooked. When asked about what constituted the most significant development in bass string design, even rival manufacturers are quick to point towards the roundwound string. Rotosound simply refers to it as the world's first "electric rock-and-roll bass string".

Since that revolution, evolution of the bass string has taken place. Modern manufacturing techniques, core designs and materials and futuristic treatments have all been added to Rotosound's basic design by both Rotosound and its competitors. D'Addario, Elixir, and DR offer strings with a coating to improve life, although each has its own preferred method and style of coating. For many years, Dean Markley has offered a bass string that undergoes cryogenic treatment. That's freezing to you and me. And US bass string company S.I.T advocates a new process where a phosphor bronze under-wrap sits under the main wrap before being subjected to its Fusion Process, using electricity to bond the cover-wrap to the core, thereby eliminating dead spots in the string and giving it the best sound possible. Freezing? Gore-Tex coating? Electron bombarding? The perfect string for Entwistle's Frankenstein bass perhaps?

STRING ANATOMY

String cores

In the 1950s, strings were wound on to a central round wire core, but production variations led to the introduction of the hexagonal wire core. For decades, strings were designed using the 'hexacore' design. However, string technology has developed to such an extent that several string producers have returned to the round core design originally used in piano string manufacture. The theory is that roundcore wound strings offer greater flexibility, clearer tone, potentially maintain their 'playing life' for a longer period of time, and require less tension, thus reducing stress on the neck. Nevertheless, the hex core is still a popular choice and many makers still choose it over a round core. Richard Cocco of La Bella strings is quite categorical about the matter: "Using a hex core is the foundation of building a good string."

Elites' range of strings uses a hex core and the company points out several hex core advantages. "We use hex core for several reasons; hex suits finger, thumb and pick styles equally, giving improved performance and long life compared to round core. A hex core provides greater 'purchase' for the string outer wrap – if you trim a round core string to length there is a tendency for the wrap to unravel, resulting in a useless string and a waste of money!" D'Addario make the point very strongly. "We only use hex core. Hex forges a tighter bond between the wrap wire and the core. This creates a more consistent, brighter string with longer life and better intonation. Round core strings have more of a tendency to slip and move once they are stretched or bent. Strings are not as bright, do not stay in tune as well, and do not last as long."

Round core strings tend to be slightly more expensive, owing to the increased production methods required, but they still have their fans. German bass manufacturer Warwick opts for a round core. "We use round core as round core strings don't feel as stiff as hex cores." And then there are the companies that can see the advantages and disadvantages of both types of core, such as Fender, DR, and Status, which produces its own UK-sourced Hotwire bass strings. As owner Rob Green says, "We supply both hex core and round core strings. Hex core is easier to produce and generally preferred by most manufacturing companies. The wrap grips onto the hexagonal core wire better than a round core because of the slight 'points' on the wire. The downside is that the 'points' tend to get flattened after playing for a while and the tone of the string suffers. A round core will tend towards a cleaner tone that should last longer and feel a little more flexible."

String wrap

The next area for consideration is the type of winding around the core. Essentially there are three choices available. Roundwound strings tend to be the most commonly purchased strings and offer a bright, harmonically rich sound, although this can lead to string noise when moving your fingers around the string. They can also increase the potential for fret wear, although, for most players, this isn't a consideration, due to the benefits in tone. Flatwound strings do eliminate string noise and provide a more

MARTIN HOW OF ROTOSOUND ON JACO PASTORIUS'S STRING COLOURS:

"Jaco wanted a different colour silk wrap on the end of each string because he felt each string represented a different 'colour'. We did that for him and later adopted the same idea on our Spacer string sets as a tribute to Jaco. The colours he went for were blue, red, yellow, and green, and he used our regular 66L sets: .045", .065", .080", and a .105" on the bottom E."

traditional tone akin to upright bass, as they lack the bright, percussive tones of roundwounds; as a result, they tend to be favoured by jazz and fretless players. Halfwound or groundwound strings incorporate the advantages of both rounds and flats, namely a bright tone with good intonation and sustain and low finger noise. This is achieved by wrapping round wire around the core and grinding down the winding, leaving a flat surface on two sides. In theory the groundwound offers the best of both worlds but, in practice, they are the least popular string of all, with upright, Jamerson, and Motown fans opting for flatwounds, and just about everyone else going for roundwounds. Dean Markley does produce an unusual hybrid known as the Fretmaster string. The section of string from the bridge to the end of the fingerboard is roundwound whilst the section covering the fingerboard itself is groundwound, the idea being that the feel and lesser wear of the groundwound is offered together with the bright tone of the roundwound string.

Materials

The most popular string materials are stainless steel and nickel. Steel-wrapped strings offer a bright, clear tone but can lead to some fret wear, whereas nickel strings have a softer feel with a warmer tone; they have less initial brightness but retain their original tone longer than steels, while being less harsh on the frets. Fretless ace Gary Willis offers this explanation of the differences between the two: "Stainless steel in my experience stays very bright for a long time, but when it goes dead, it does so very rapidly. Nickel tends to lose its tone very gradually over the same period of time."

Rotosound has heard this question more than a few times and is at pains to explain some of the key factors to consider. "We have found over the years that musicians tend to offer a mixture of reasons as to their preferences. Firstly, let's be quite clear about the core material, which is produced from a very high-tensile piano wire, is coated with tin or zinc, and applies to both stainless steel sets and those of nickel. The ferritic stainless steel wrap wire is, in fact, a chrome iron with iron accounting for some 80 per cent of the alloy. True austenitic stainless of the totally non-corrosive kind would not respond to the magnetic field and hence would be totally unsuitable for electric bass. Looks nice though! Unlike stainless, nickel strings normally comprise an eight per cent nickel plate over a mild carbon steel wire. It used to be soft iron at one time, but became expensive, so wire manufacturers sought an alternative. These two elements in themselves offer a distinctly alternative sound to that of stainless, and whilst not having the same degree of presence, it does offer a good, full sound throughout the range, suitable for a wide variety of music and playing styles. Nickel-plated strings offer a superior finish to the lesser hue of stainless sets and resist moisture and amino acids more effectively, on account of the protection offered by the plating. The high iron content of ferritic stainless can result in surface marking in conditions of high humidity and where high skin acidity levels prevail with the player."

Tonally, GHS summarise the differences thus: "Nickel offers a punchier mid- to upper-mid range tone with a tight low end." Stainless, meanwhile, "focuses more on the upper-mid to high frequencies. It also has a very tight and full low-end response and a little more volume than nickel as well". Status's Hotwire sets are available in one material only, a rare move amongst manufacturers these days, but Rob Green feels the benefits are worth it.

JOHN ENTWISTLE ON HOW A ROCK STAR BUYS STRINGS WHEN RECORDING:

"I started doing the solo [for 'My Generation'] on a Danelectro because I liked the strings, and the Danelectro solos were a lot faster than the final solo. We were doing concerts at the same time we were doing the recording, so I was breaking strings, but you couldn't get the strings for them so I had to buy a new bass each time. I had just broken a string on my third Danelectro when they said we were recording at 10.00! I didn't have another bass so I went out and bought a Fender Jazz Bass and put on some tapewound La Bellas. That was all the shop had. So I ended up using an amp, which was a Marshall 50-watt, a 4 x 12", and a Jazz Bass with flatwound strings."

"We currently only supply stainless steel strings. The tone is generally less harsh with more pronounced low and high frequencies." D'Addario sums up: "We characterise them as follows: stainless steel = super bright; nickel = bright."

Try a restring with a set of nickel bass strings followed by a restring with a set of stainless steel bass strings if you want to hear how each material works on your set-up. Remember, you can tailor the sound of your bass massively with a change of string, so experimentation is essential. In an attempt to provide the best of both worlds, La Bella makes the wonderfully named Slappers, a set of bass strings with stainless wrap underlays and a final nickel wrap providing the feel of a nickel string but with the brightness of stainless. So in theory, you can have your cake and eat it.

Some players may experience some discomfort when using nickel strings, due to an allergic reaction to nickel and the metallic components of the nickel used in the strings. In response to this, some string manufacturers are now changing their nickel sources to reduce the problem. The feel of a bass string influences the playability of your bass, and so it comes as no surprise that different materials have differing characteristics. D'Addario offers the following advice: "Stainless steel tends to be more coarse and rough. Some players like this, while others have issues with what is sometimes described as a 'tacky' feel. We described the feel as 'highly textured'."

String variations

In your search for the perfect tone you will encounter strings intended to provide further longevity or enhance tone, such as those made from phosphor bronze (for acoustic and semi-acoustic instruments), gold, cryogenically frozen steel (to offer improved 'string life'), and black nylon (used instead of metal windings, reducing fingerboard wear on a fretless bass and offering a traditional upright tone). While it sounds unusual, Paul McCartney recorded a great deal of the *Sgt Pepper's* album with Rotosound's black nylon Tru Bass strings, so if your Beatles riffs don't quite sound right, you might want to invest in a set of these. The latest advance in string improvement, however, is the use of a protective coating over the final metal wrap. These relatively new types of strings are becoming increasingly popular and were first seen on bass guitars with the Elixir brand, which used a Gore-Tex coating (the same as the waterproofing on clothing). Two things stuck out when these strings were released (and used as standard equipment on some bass guitars such as high-end Ibanez models). Firstly, replacements weren't cheap, and, secondly, the string offered a new feel for the player, a bit like, well, Gore-Tex. Later refinements such as the thinner Nanoweb coating led not just to a widespread acceptance of the coated string but to many other manufacturers following suit. D'Addario calls its coating EXP, with the claimed benefit of coating the wrap before the string is fully wound, to offer the feel of a traditional string but the extended life of a coated string.

String gauges

The string gauge is essentially the thickness of each string. In order to accommodate the tuning of the bass guitar, each string will differ in its thickness, and the string gauge is often referred to by listing the lightest and heaviest gauged strings. The question, "What strings do you use?" could well be answered by "45 to 105". That doesn't mean the player doesn't bother with the middle two strings, he's simply using convention. Strictly speaking,

THE STRING PARADOX

"Strings are a bit of a paradox; some of the finest, fattest recorded bass sounds have been achieved with heavy, old flatwound strings (for instance, Motown's James Jamerson or Bernard Edwards's Chic/Sister Sledge recordings) but these can be much harder to articulate," says Elite's Nick Owen. "A brighter string will aid 'cutting through' live and therefore suits more percussive styles; thinner strings allow faster playing but provide a weaker tone and go dead more quickly. Most players arrive at a recording session with brand new, zingy strings on their bass but many studio pros recommend recording with a deader string and tweaking the preamp to get the required amount of top-end for the perfect bass sound."

each gauge should be preceded by a '0.', showing the actual measurement in thickness of an inch; 0.65" for example. Some companies use the 0, others don't – the gauge should be evident no matter which system is adopted.

Why the differences? Some gauges work better for certain styles and have specific characteristics, some work best on basses with certain features and scale lengths, and some are unique custom designs for specific purposes. With such a range of gauges, it's probably best to start by asking yourself whether or not you're happy with what you are currently using – to newcomers that will probably be the gauge the manufacturer deemed suitable for your bass. The most popular gauges for four-string bass are 45-65-85-105 and 40-60-80-100. Lighter gauges such as 30-50-70-90 and 35-55-75-95 offer increased flexibility, and a lighter feel, of particular assistance for those struggling with the physical action of pressing down the strings. For advanced players, lighter gauges aid string bending and slapping. Because they require less tension and pressure, they have less tone, sustain, and overall volume, due to lower mass, but this can be overcome on basses equipped with powerful pickups and active circuitry.

Discovering your instrument's string gauge is done with a micrometer. This will measure each string to thousands of an inch. Don't be alarmed if you find slight variations, 0.105" can often become 0.104" or 0.106", depending upon the manufacturer. If you are unsure, and neither you nor your store has access to a micrometer, then it's a safe bet your instrument left the factory with 45-65-85-105. Heavier strings offer a louder, fuller tone but are less flexible. 50-70-90-110 is certainly getting heavy for a four-string bass. Heavier gauges come into their own however should you need to use a drop tuning. The heavier gauge becomes more critical because the reduction in tuning leads to a floppier feeling string if the gauge is left as standard. The increased popularity of heavy metal and its spin-off genres has led to increased popularity in drop tunings to match the tunings of the guitars. Some four-string players use the bottom four strings of a five-string set and then drop tune the entire instrument. Heavier gauges do increase neck tension, so it's probably not a good idea to stick a set of 50-110s on a 1951 P-Bass.

The mass required to tune to the low B of a five-string bass involves the use of some seriously heavy string gauges. 0.130" is often seen as a great balanced low B on a 45-105 set, but lighter gauges of 0.125" and 0.120" or heavier gauges of 0.135" are also common. It's purely player preference; experimentation, and the characteristics of your bass and playing style that will make the final decision.

Finding the right gauge is critical if you want to avoid having your bass readjusted. A change of gauge will require readjustment of the bass's action. That's part of reason the adjustable parts – truss rod, saddles and nut – exist. So experimenting with gauge could mean a bill for new strings and a session on the tech's bench. (See Maintenance, p64.)

The scale length of your bass will have a bearing on the gauge of string most suited to your guitar; the scale length or 'mensure' being the distance from the point where the string passes over the string saddle at the bridge to the point of contact at the nut. A 34" (864mm) scale will accommodate all gauges reasonably well; a medium-scale 32" (813mm) scale requires a heavier gauge in order to provide enough tension, although a heavy gauge on a 32" scale will feel similar to a standard gauge on a 34" neck. A 35" (889mm) extra-long-scale neck may benefit from a lighter gauge as the added string length and tension on the neck can make the strings feel a little stiff. But in the case of a

five-string bass, this added scale length with a standard gauge can prove beneficial in improving the tone of the low B-string and maintaining a good overall tone across the neck of the bass. Short-scale basses using a 30" (762mm) scale length aren't as rare as you might think. The Hofner 500/1 'Beatle Bass' and its variants, many of the Gibson EB models, as well as a plethora of student three-quarter size basses utilise 30" scale lengths. Attempting to use a longer scale-length string will not allow the correct wrap around the machinehead, and you will usually discover this after cutting the string to length. Don't expect a refund when you return to the store red-faced, and don't accept the patter that suggests all bass strings are the same. It's better to have old strings of the correct length than incorrect new ones.

Ball-end technology

So what about the ball-ends that hold the string in place? For those with headless instruments, double ball-end strings are an option. Although most headless basses can now use single-balled strings through the use of grub screws at the end of the neck, double ball-end strings have a massive advantage in that they facilitate rapid string changing, which is a particular bonus in a gigging situation when a string snaps suddenly. Most ball-ends are simple brass rod with a channel routed out to hold the core wrap in place, although Bass Master strings feature a completely spherical ball-end that has the advantage of providing a bigger contact point at the bridge.

At the bridge end, there are even more choices to be made with tapered windings and non-tapered windings, although in most cases manufacturers either make this a feature on all of their string ranges or not at all. Tapered windings at the bridge are supposed to offer greater tone, clarity, and tuning/intonation stability with increased harmonic response. In practice, such claims are realistic, although, perhaps, in a gigging situation, the benefits are not so noticeable as to make one switch from one brand to another. Again, each maker has his own preference, as Warwick explains: "Tapered strings can vibrate freely with their thinner part, which lies on the bridge. Players with harder attack might face problems with their dynamic response, however. The feel is softer on a tapered-core string, regarding the tension. We use taper cores on the low B-strings to optimize the balance of the tension, feel, and sustain to the other strings." D'Addario takes a very technical approach with taper cores although it states that ultimately there is little difference in feel. "The main advantage of a taper-core string is that it allows the fundamental frequencies of lower strings (which have a lot of mass at the bridge) to be more defined and clear. The outer wrap wire is stopped just short of the ball-end, exposing the under windings. The less mass there is over the saddle, the more defined the tone will be. Traditional wound strings, particularly low B-strings, can sound floppy and undefined on some basses." Elites leave a lot of choice to the player with some sets offering taper and others not. "We only offer taper core option on our B-strings, since our standard strings have hex cores, which we consider bright enough to start with. The taper core option is felt by some people to improve harmonic response, clarity, and aid string intonation; however, others feel that a stepped core can make string oscillation uneven. We supply a non-tapered B as standard in our five- and six-string sets, but provide a tapered B in our Nathan East signature set or as a custom single."

In some cases the core of the string is completely exposed and has no winding where

the string passes over the bridge saddle. This type of design originated with Rotosound, and was known as the piano string design. Rotosound offers the following observations: "Less mass on the bridge saddle allows for more freed-up movement of the string, offering great sustain. It also enhances string flexibility and bending for certain playing styles. Tonally speaking, it's very rich on the highs; however, it is as well to go for a heavier gauge if you desire the heavier lows. The action usually requires some adjustment to obviate fret buzz." The last point is extremely valid. If you alter the gauge of your string, or move to a string with a tapered core, you should have your bass guitar action re-adjusted for both playability and intonation. Only if you specify identical gauges will you be able to leave all well alone, although an intonation adjustment wouldn't go amiss. Moving to a lighter gauge from a heavier gauge may even require a new nut to be fitted.

A feature of many older instruments is the ability to string a bass through its body rather than anchoring the strings at the bridge. The principle behind this is that, by passing the strings through the body, it is possible to achieve greater sustain as the string vibrates through the whole of the guitar; the first point of contact for the string is with the body rather than the bridge. Schaller and other after-market bridge designers now produce bridges that give the player the option of stringing a bass using through-body stringing or standard stringing via the bridge.

STRING MAINTENANCE

I often tell my students that their bass could do with a new set of strings, knowing the benefits one can gain through a fresh set of 'wires'. More often than not I'm told, "Oh, but these are new; I only put them on last year." How long a set of strings will last is determined by several factors: how often and for what duration the strings are played, humidity and climatic conditions, smoky atmospheres (particularly prevalent on the pub and club circuit), the nature of your playing and the amount of sweat and dirt that comes into contact with the strings.

So how can we make our strings last longer? Well, any string will eventually lose its tone and elasticity through use, as dirt builds up under the string and enters the windings, killing the tone. It also greatly affects the intonation of the bass, as studio legend James Jamerson found to his detriment when he proudly boasted that he never changed his strings unless they broke. Unfortunately, when the out-of-tune upper register could be heard at the mixing board, producers would in desperation call another session player to finish the piece; sometimes that was his own son, James Jamerson Jr. However, a few steps can lead to extended string life. Cleaning your strings with a cloth after every playing session will help to remove grease, dirt, and sweat from the windings. You can't prevent your fingers from producing string-killing chemicals, but at least you can remove them afterwards. If possible, wash your hands before you play. String cleaners and fingerboard cleaners can also prove beneficial. Strings with a long-life coating may be worth the extra.

String prices are now so keen that I wouldn't recommend the old trick of boiling your strings to prolong string life. Firstly, the tone is never even close to the original, the feel is horrific and removing all the oils merely speeds up the deterioration process. Remember it as something your mum or dad did all those years ago.

String-changing tips

Changing strings is usually carried out because of a loss of tone or breakage. In theory they shouldn't break, considering how thick they are comparison with those on an electric guitar, but in practice they can and do. Heavy-handed technique can kill a string over time, causing the string to lose its elasticity and making it susceptible to breakage at its weakest point, as it passes over a bridge saddle. Also over-tuning can result in an over-

TOP: cutting the excess string (left); inserting string end into tuning post (centre); starting to wind (right).
BOTTOM: using a string-winder (left); tensioning (centre).

tensioned string that can easily let go at a future date. Even new strings on a bass can break if not strung correctly. You will requiire the following tools: side cutters/pliers, string winder (optional), headstock rest.

■ **Step one:** make sure you have the correct gauge and type of strings for your instrument – it sounds obvious but mistakes can be made and you don't want a mid-gig breakage. Support your bass headstock if at all possible; this makes the job easier and reduces pressure on the weak joint on through-neck instruments. Planet Waves makes a neat portable neck support that folds down to the size of a pair of pliers.

■ **Step two:** decide whether you want to remove a string at a time or remove all the strings in one go. By opting for the latter, you can give your bass some love and attention. Take the time to clean your bass front and back, check the tightness of all screws and pickups, lubricate the fingerboard, and assess the set-up of your bass. Check the bridge saddles for any string damage and sharp points and check that the nut has been cut correctly for the string gauge you intend to use. Once the strings are installed, you can assess the relief of the neck, the intonation, and the action.

■ **Step three:** usually there is too much excess to put the entire wrap on the post, although some players swear this gives a better sound. Too much string on the machinehead (tuner) post can affect sustain and lead to tuning problems involving string slippage. Too little string around the machinehead post will result in the string rattling in the nut and more tuning instability. I use my index finger as a measuring guide. Anchor the string firmly at the bridge and pull the string up to the post. I then use slightly less than my index finger length for the E- and A-strings, and a shade over for the D- and G-strings. This should give two or three full turns around the post. A little experimentation will be required here. Then cut the string to length.

■ **Step four:** insert the cut end into the hole in the centre of the machinehead and wind the string around the post, ensuring that each wind lies underneath itself and the final wrap ends up at the bottom of the post. This is to create downforce on the string over the nut. You can start the wind by hand and then finish it with a string winder such as the Planet Waves Ergonomic Bass Peg Winder.

■ **Step five:** problems can occur with bridge designs that don't secure the string ball-end in place until tension is applied. Make sure the string hasn't come out of the bridge when performing the tensioning of the string. Sometimes you need to hold the ball-end in place, tension the winding at the post and turn the tuning button; a challenge indeed.

■ **Step six:** don't over-tighten the string. Over-tensioned strings can place excessive stress on the neck and damage the strings. Once you have all the strings on, tune the bass up to concert pitch. Play the strings for a few minutes then gently stretch the strings by waggling them from side to side and away from the neck. Then retune the string again. Do this until the tuning remains relatively stable. Failure to carry out this part will result in slippage of up to a tone or more.

Ultimately, we all have our personal preferences, and what feels and sounds right to one player may not be as suitable for another player. And there is no rule that says you must use a type of string for any instrument specifically. Each type of string has its advantages and disadvantages; the ideal is to obtain a happy medium and find what sounds best to your ear.

BASS MAINTENANCE

The set-up or action of a bass guitar is often seen as some sort of mystical science, but in reality it's experience and self-belief that stop many trying to solve problems on their basses. All basses require setting-up to become decent playing instruments. The set-up process involves adjusting the action – the distance from the bottom of the string to the fret; both terms are widely used. The set-up may need to be adjusted if you have a problem such as buzzing of the strings, the bass sounding out of tune in certain places, excessively high action or poor tone. More often than not there is a desire to improve the set-up that the bass came with. A good set-up can take anything from half an hour

to several hours or more. You can bet that the factory did not lavish such attention on your instrument, unless it is of a high-end nature. One highly experienced luthier told me he set up 100 instruments a day for a large instrument distributor.

Bass set-up is always about personal preferences rather than exact measurements and can be considered as being no more complicated than, say, basic car maintenance. So, perhaps the first thing to ask yourself before lunging for the truss rod adjuster is whether or not you have some sort of aptitude for mechanical tinkering. If the thought of changing the spark plugs and oil on your car seems like a nice way to spend a Sunday afternoon, then you should find no problems (other than gathering experience) attempting some adjustments on your bass. If you're not even sure how to check the oil in your car, maybe its best left to an expert. You can always spend more time practising that way. I still have some mods and adjustments carried out at professional workshops, but I undertake simple tweaks personally. If you are in doubt about these adjustments, then leave well alone; at best you may render the bass unplayable until adjusted professionally, at worst you may render it unplayable permanently. So it is best to resist the urge to tinker the morning before a gig. You need time and space for a decent job, including time for emergencies in case you do need to take it to a professional.

Going pro

There are also some steps to consider if you decide you do want to take an instrument to a professional. That may be a local store, individual repairer, or bass specialist. Personal recommendation is *always* the safest method; no matter how glossy the ad, or how shiny the workshop, it is repairmen with experience who normally do the best job. An initial visit may be worthwhile, just to ask a few questions; "Can you look at my bass for an initial appraisal first?", "How much will it cost?", and "How long will it take?" When you do decide to go for a pro set-up, make sure the person is asking the right questions about how you want the bass adjusted. Personally, I like a very low action, accepting that it will buzz in certain places – not a problem for me – but will the repairman fulfil that requirement? It's your action – you decide. If you are unsure, try a few other instruments to see how they feel.

The DIY option

If you fancy doing it yourself, here's the correct way to adjust your bass in stages.

■ **Step one:** decide your string gauge. The action of your instrument is affected by the gauge of string you use – so after an initial experimentation phase, it's a good idea to settle on the make and gauge of string you are going to use. This will determine the amount of tension in the instrument, particularly at the neck. Restring the bass (see Strings, p63).

■ **Step two:** get the bass in tune. For most of us this will be concert pitch. But if you use a drop tuning, say low E to D, then you need to adjust your bass with this tuning in mind.

■ **Step three:** adjust the height of the nut. The nut must be set so it doesn't hit the first fret when played in the open positions (nut too low) and doesn't play out of tune when

you fret a note (nut too high). To check this carry out the following test. Place a finger between the second and third fret, and hold the note down. Then tap down on the string at the first fret with your other hand. There should be a small gap evident between the bottom of the string and the first fret, or an audible click when you do this. The measurement at the E-string would be somewhere in the region of ten thousandths of an inch (0.25mm) and slightly less for the G-string, about eight thousandths of an inch (0.2mm). In other words, it is a very small gap. This is where a luthier's experience comes in very handy.

More often than not you need to lower nut height, which involves filing the nut slots down. If the nut is too low, and the instrument is buzzing on the open position, the string is hitting the first fret. You need to remove the nut and either replace it or shim it with a piece of veneer (or similar).

■ **Step four:** tune up again. You'll discover that correct set-up needs you to constantly tune the bass to correct pitch.

■ **Step five:** check the neck relief. Neck relief is the amount of curvature in a neck and is adjusted via the truss rod.

There are normally three choices here; a straight neck, a slight concave bow downwards (the fingerboard and neck curve away from the strings) or a slight convex curve upwards (the fingerboard and neck curve towards the strings).

To 'sight' the neck we look down the instrument from the headstock as if aiming down a rifle barrel. Luckily, we have a straight line reference point – our bass strings – so use this as the straight line point and examine how the neck appears underneath it. The ideal is a slight concave bow, but on occasions all sorts of other scenarios can present themselves. One half of the neck can have a different curve to the other. There may be a pronounced rise where the neck meets the body or the neck may appear completely straight. A slight bow is required to let the string vibrate (it moves more in the middle than at the nut or bridge). But just how much bow is needed?

'Sighting' the neck before adjusting neck relief.

To check this carry out the following test. (A capo makes this test much easier but some dextrous hand movements make it possible without.) Hold down the first fret – or place your capo across the first fret position – at the E-string and then hold down the last fret simultaneously. Then tap down between the seventh and ninth frets approximately to see if you can hear an audible click, as in our nut test above. There should be a small amount of relief. How do we achieve that if we don't use a capo? Simply use your elbow to hold down the last fret; tricky but employed by many techs who are in a hurry or who don't have a capo handy.

■ **Step six:** adjust the neck relief. (Note: over-adjustment of the truss-rod can damage your instrument beyond repair; if in doubt – don't do it.) Neck relief is adjusted via the truss rod, using the correct truss-rod key or Allen wrench. Although it applies to any tool adjustment, using the correct device is essential. The adjuster can be damaged and rendered useless if the wrong tool is used. Pedulla basses use a dedicated truss-rod adjuster with a built-in wooden handle for extra leverage, while Peavey and Music Man use a neat spoked wheel system that allows one to insert a small-diameter steel rod for

adjustments (usually this is the nearest small point screwdriver). Some bolt-on instruments (especially early Fender designs) require the removal of the neck to access the truss-rod adjuster – a more time consuming operation. Make small adjustments at a time, usually no more than a quarter of a turn and then check the results. Sometimes the neck may require a short period of time to settle into its new position. If there's one operation that sends players off to the pros, it's truss-rod adjustment. Be patient, and if in doubt, don't adjust!

■ **Step seven:** tune up again. Sometimes retuning will require another very fine tweak at the truss-rod.

■ **Step eight:** adjust bridge height. The bridge assembly or individual saddles now need to be adjusted. This is to ensure that the string doesn't collide with the frets when playing. Adjustment may be by a twin-pillar arrangement or by adjusters on each individual saddle. The distance we are after is measured from the bottom of the string to the top of the 12th fret; 1.5mm (0.06") to 1.8mm (0.07") for the bottom E and 1.5mm (0.06") for the top G on a four-string bass is a low action for a player with a light touch. If, like many of us, you dig in a little harder, then an action of 2.5mm (0.1") on the E and 2mm (0.08") on the G is less likely to get fret buzz and provides a higher action. The heights should also follow the curvature of your fingerboard, which will depend upon its radius. Bridge adjustment is often the tweak most players feel happiest doing (there are no dire consequences if you get it wrong). Sometimes it can work to stop string buzz but often you compromise other aspects of the playability by missing out the other important stages.

■ **Step nine:** guess what? Tune up again. Bridge adjustment always requires you to retune.

■ **Step ten:** intonation adjustment. Intonation adjustments are required so the string plays in tune from the lowest note to the highest note. We need a tool to adjust the intonation screw that moves the saddle back and forth. Some basses (acoustic basses, Hofner Violin basses, and fixed saddle basses, for example) have more limited adjustments for intonation or none at all. To check intonation, carry out the following test. Using a good quality tuner, play the open string and compare it to the fretted note at the 12th fret. It should be the same note. If the fretted note is flat you need to shorten the effective string length by moving the saddle forwards towards the nut. If the fretted note is sharp you need to lengthen the effective string length and move the saddle back away from the neck.

If you stick to the same gauge and make of string you shouldn't need to change intonation. Strictly speaking, if you change make but not gauge, as core sizes can vary, it's worth doing an intonation check. Dead strings often sound slightly sharp because crud gets in the 'valley' of the string winding and increases the mass. Only perform intonation adjustments with new strings – unless of course you like the sound of dead strings.

■ **Step 11:** pickup height. Pickups are adjustable in height and lateral movement to provide good string-to-string balance and output. They need to be far enough from the

The truss-rod adjuster is at the end of the neck. Make sure you use the correct tool. (Here the screwdriver is only being used as a pointer to illustrate the location of the adjuster.)

strings so the string doesn't make contact during playing and experience a magnetic pull, yet close enough to give good output. Moving the pickup too far away can also lose some of the initial instant attack some players love and others loathe. Once again, it's a personal matter.

The bridge pickup is usually closer to the strings than the neck pickup because the string is vibrating less at that point than at the neck. Some pickup manufacturers calibrate their twin pickup sets making the bridge pickup higher in output to accommodate this trait. Measurements vary between pickup types (active/passive, single coil/humbucker, P/J-style etc) but a guide would be bridge pickup approx 3-4mm (1/8") distance at the G and 4-5mm (3/16") at the E-string; neck pickup 4-5mm (3/16") distance at the G and 5-6mm (1/4") at the E-string.

Problems

Sometimes, a full set-up still leaves problems. This usually does involve some expert help, but this section will help you communicate any potential problems to the experts and let you understand their diagnosis.

PROBLEM: BUZZING AT ONE OR SEVERAL INDIVIDUAL FRET LOCATIONS

- DIAGNOSIS: isolated high/low frets.
- CURE: fret dress. All frets are lowered to equal height and then re-profiled (or crowned) to retain their original rounded profile. If too little metal is left on the frets a full re-fret is required.

PROBLEM: UPPER REGISTER PLAYING AND CHORDS SOUND SLIGHTLY OUT OF TUNE. INTONATION PROBLEMS

- DIAGNOSIS: faulty string(s) or limitations of standard nut design,
- CURE: new string(s) or fitting a compensated nut. The former for beginners; the latter, as offered by firms such as Buzz Feiten and Earvana, strictly for an expert.

PROBLEM: NOISY, SCRATCHY SOUNDING CONTROLS/CRACKLY JACK SOCKET

- DIAGNOSIS: worn or dirty contact surfaces.
- CURE: clean with electrical cleaner such as Servisol, or replace pot or jack.

PROBLEM: LARGE IMBALANCE BETWEEN PICKUPS OR NO OUTPUT AT ALL

- DIAGNOSIS: usually wiring fault or faulty pickup.
- CURE: see Changing A Pickup, p69.

PROBLEM: LIFELESS NOTE AT CERTAIN PLACES ON THE FINGERBOARD

- DIAGNOSIS : dead spots, where string resonates unfavourably.
- CURE: this is inherent in most wooden instruments and cure is virtually impossible. However, the dead spot can be moved by increasing mass at the headstock. Studio musicians would often tighten a G clamp (C clamp in the US) at the headstock to move the dead spot if it interfered with the notes being used. Thin brass plates, shaped and fitted to the headstock, are another solution, offered by Groove Tubes.

Changing a pickup

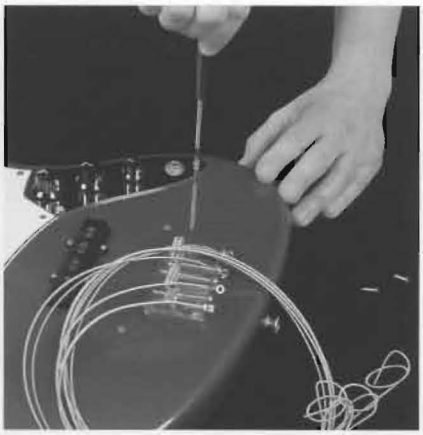
To install new pickups in your bass, you'll need screwdrivers, wire strippers and cutters, rosin-core solder, and a soldering iron. Don't use a soldering gun; it can demagnetize your pickups. If you are not confident in your soldering abilities, it's a good idea to take your bass into your local tech. A small sum spent wisely at this juncture can save you later, and may save your instrument.

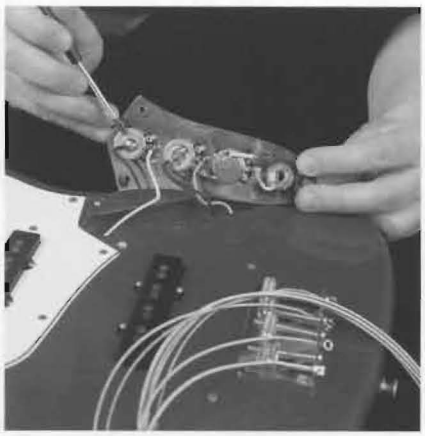
While each bass is slightly different, if you follow these general steps you should be on your way.

■ **Step one:** remove the strings from your bass. This makes it easier to remove pickups and pickguards without scratching the bass.

■ **Step two:** get access to the wiring by removing the control plate, pickguard, or rear control cavity cover(s) as applicable. If you have to lay the pickguard on the top of the bass, place a soft cloth between the pickguard and the body of the bass. Be gentle! It is very easy to scratch lacquer finishes.

■ **Step three:** draw a diagram of the way your bass is wired. Pay particular attention to the wires coming off the existing pickups, noting their colour and where they are attached. This will help you remember where the connections went. It is also worth locating a wiring diagram for your bass. Who knows, maybe the thin, weedy tone is the result of a previous incorrect wiring job?





Use a small screwdriver to remove the control plate (left); make a note of the existing wiring layout before you start unsoldering (centre).

■ **Step four:** carefully de-solder the pickups from where they are currently attached and clean the excess solder off of the parts with solder wick. It's always easier to solder onto a nice, cleaned part than one that has solder splattered all over it.

■ **Step five:** take a minute to note the old pickups' orientation in the instrument and then remove them. Wrap the old pickups in a soft cloth or paper towel and store them in a cool, dry place away from magnetic interference. This will keep them ready if you'd like to put them back in the bass at a later date. This is essential if you have a vintage or collectible instrument, as non-original parts will affect the value considerably.

■ **Step six:** install the new pickups where the old ones were, making sure that you retain the proper orientation.

■ **Step seven:** run the new wires back to the controls that the old pickups were attached to. Measure the wires to the proper length – long enough to make it to the connections with at least an inch or so extra for slack – cut and strip the wires, and carefully solder them onto the old connections.

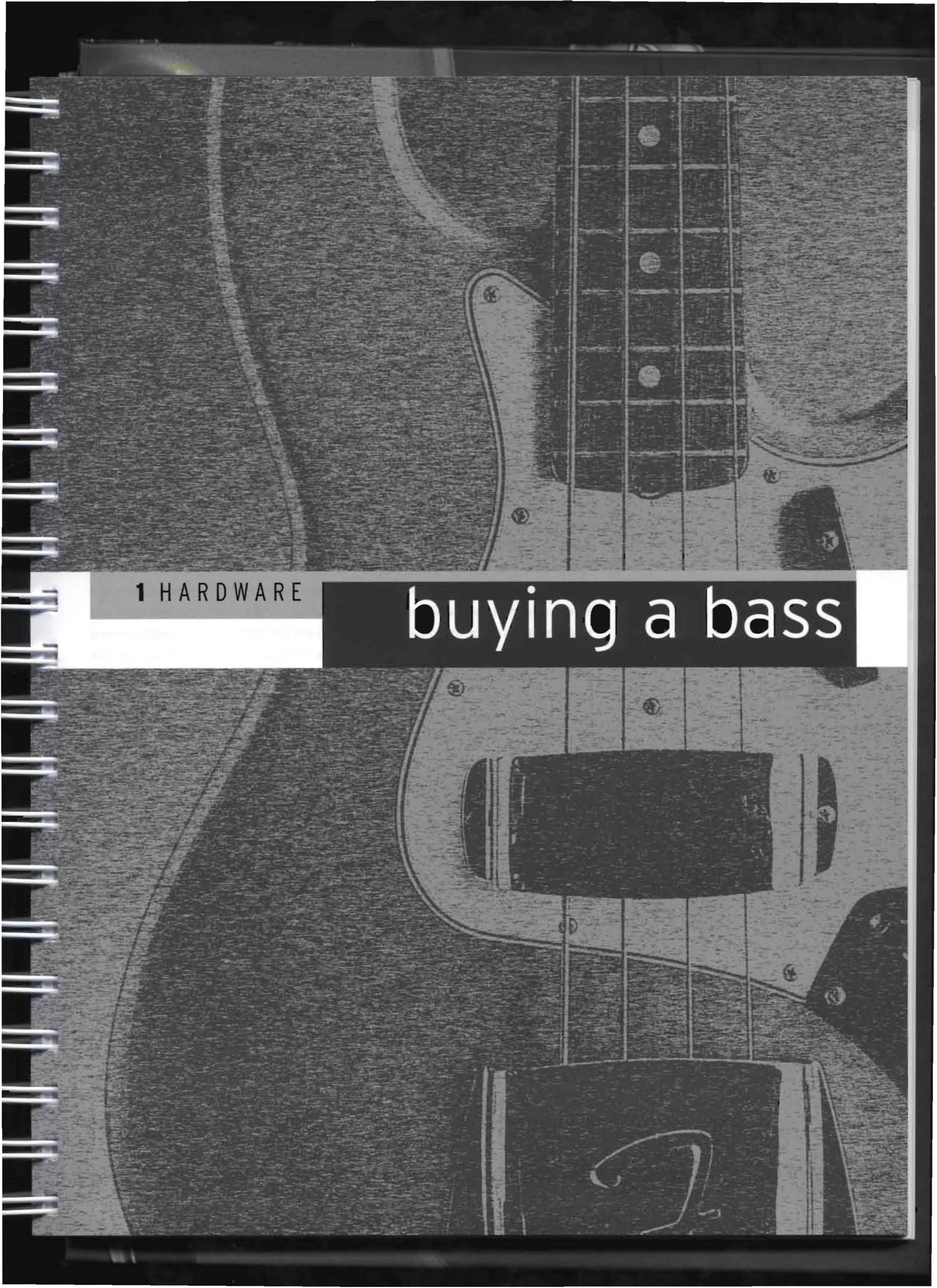
■ **Step eight:** reattach the pickguard and/or control cavity covers, string up the bass, adjust the pickup height, and test your new pickups.

Cleaning

How you clean the body depends on the finish. Lacquer finishes need good quality instrument-specific polishes so that any future repair work to the finish isn't hindered by the presence of silicones. A finish polish that can also be used on the hardware makes sense. Use a lint-free or napped cloth rather than a cheap domestic polishing cloth that leaves residue all over the instrument. Some companies produce buffing type cleaners that restore finishes using a coarser compound to remove scratches and minor marks. For mild blemishes try Planet Waves Restore Deep Cleaning Cream; for heavier blemishing try Manson Finish Restorer. Final polishing for that as-new shine is carried out with spray-type polishes of which there are many. I have used Ritter Surface Cleaner, which is claimed to be safe on vintage finishes. Planet Waves takes the cleaning stage one step further, dividing its cleaners into three stages, adding Protect Liquid Carnauba Wax and Shine Spray Cleaner to the aforementioned cleaning cream.

Wood finishes require different treatment. Warwick basses, for example, require the regular application of the beeswax supplied with each bass. Their oil-stained finishes, however, only need simple surface cleaning with a cloth.

Cleaning the fingerboard has several benefits. You would be surprised by the amount of dirt that can accumulate on a fingerboard over time; I have seen several requiring removal of crud by a scraper. Yuck! Apart from the obvious benefit of it feeling more pleasant when you play, clean fingerboards mean less dirt is pushed into the string, which means longer string life. Re-fret operations are also easier on a fingerboard that's been well oiled over time. The above applies to rosewood or ebony fingerboards and not lacquered maple boards. These simply need cleaning with a cloth, the lacquer doing its job of protecting the finish. Fingerboards need specialist cleaners, often based on natural oils to nourish the wood. Very little is required, however; a small bottle should last a long time. I've used Manson Fingerboard Oil (with lemon oil) and Lizard Spit (with orange oil) both of which remove grime and leave a wonderful aroma after use.



1 HARDWARE

buying a bass

Perhaps it's the business of having to deal with just those four strings, but bass players do seem to love simplicity. That's why with a few exceptions the simplest designs of bass guitar, based on Leo Fender's original Precision and Jazz types have largely stood up to players' changing requirements. So when you go to the music store or follow up a private ad in search of your new bass guitar, the first thing you should bear in mind is simplicity. Do you need more than a volume control and a tone control at first? Shouldn't think so. Do you need an active circuit? Probably not, at least to begin with. Keep it simple. You can get complicated later, if you want to.

IN THE STORE

So here we are at the store. First of all, pick up the bass in question and see how it feels. Don't even play it. Just feel it. Balance it on your knee as you sit with it; adjust it on the strap as you stand up and try it. Get it comfortable. Now feel the neck in your hand, and run your fingers over the strings. Play a note or two. How does it feel? I always encourage new students of the bass guitar to just play across the open strings, even if they've never played a single note before. You may be surprised at how one bass may seem more comfortable than another at this stage.

Many experienced players will tell you that they knew a certain bass was a good one as soon as they picked it up. This isn't nonsense. Once you've played a few different basses you'll realise that there are instruments which do just 'feel right' and drop snugly between the hands. On one of these basses, the particular cross-section of the neck will feel as if made for your fretting hand and, most noticeable of all, you'll be able to play freely and easily, without really giving much thought to the bass itself at all. Which is how it should be. A good feel is not all there is to a good bass, but it nonetheless constitutes a large percentage.

Equally you'll realise very rapidly after you've picked up a poor bass that this is not the one for you. Perhaps they do say it's the hottest bass around; perhaps everyone is talking about it. But if it doesn't feel right to you then it isn't right for you. Does it feel ungainly and awkward; do you have to strain to play it? These tell-tale signs will become obvious to you, so take heed. You'll soon find that you'll come to trust these first impressions.

If the overall feel is not right it may be because of one or possibly both of the following reasons. Sometimes a bass could be right for you in terms of size, shape and wow factor but it hasn't been set-up correctly to optimise its playability. A Ducati, for example, is a great motorcycle to ride, but not if one of its tyres is flat. Just putting some air into the offending tyre will transform it into feeling 'right'. The bass guitar equivalent might be a simple saddle or truss rod adjustment to create the perfect bass. In other words, your perfect bass might be in your hands already. The problem for the new bass student is that you probably won't know if this is the case or not; it might just fall into category two, a bass you simply don't gel with. If that's the case, there's very little that can be done. Any amount of deal-striking by the seller, any amount of pickup-changing and refinishing and general cosmetic fiddling, any amount of spiel from the salesman telling you that this bass is truly wonderful; all this should not deter you from the feel. You're the

bass player. You're the person with the money (aren't you?). You'll know when the bass is the right bass.

And when it feels right, then you should drag yourself away from playing the thing and examine some specific details a little more closely. Some makers or importers are better at setting-up their basses than others; some leave it to the store. And, as we've mentioned some basses don't get set up at all.

THE FIVE-STEP METHOD

There is a five-step system method that you should get into the habit of adopting when you're trying a new bass in a store, checking out a used bass in someone's home, or just looking over a friend's instrument. With this method you'll know that you've covered all the important aspects of the operation of the bass in question, thoroughly and quickly. This is how the system works.

■ **Step one:** if the bass was plugged into an amp when you checked it for feel just now, turn the volume down to zero. Play the bass acoustically, with no amplification at all, and listen very carefully and closely (literally) to the sound the bass makes. The amplified sound of the bass comes primarily from the pickup, of course, but to produce a clean and clear amplified sound, the bass guitar itself – the wood, plastic, and metal that constitute the body, neck, and hardware of the instrument – needs to vibrate in sympathy with the notes you're playing. So listen for any unusual and uneven buzzes or noises from the instrument as you play it acoustically for a few minutes. Listen to the sound of the bass: pro players often say that a good bass will 'speak' to them acoustically. So ignore the puzzled faces of any other people looking on – this acoustic run-through is, you will discover, a crucial test. They'll be doing it themselves next week.

■ **Step two:** take the bass off the strap (or pick it up from your knee) and look over the whole surface – back, front, sides, top, bottom, everywhere. Look closely at the finish for small blemishes or cracks, and examine all joins and seams for closeness and accuracy of fit. On a new bass this will tell you instantly how well the maker or factory has put the bass together and finished it; on a used bass it'll tell you how well the previous owner(s) has looked after it. Any shortcomings here may well be echoed elsewhere, so this is a good early clue to the quality of the bass you hold.

■ **Step three:** look at the action – the height of the strings above the fingerboard. If it's too high you'll find the bass hard to play. So can you adjust the action? Height adjustments can be done at the bridge or at the truss-rod. It takes an experienced eye to detect what is going on. See Maintenance (p64) or take along a bass expert to help you decide.

■ **Step four:** turn up the volume again on the amp, and put the bass back on the strap (or on your knee). Now play every single fret on the G-string, the same for the D-string, and so on through the strings. As you do this; you should not hear any buzzing coming from individual frets: if you do, it may indicate a misplaced fret, or one that needs a

repairer to file it down. Or, perhaps if we are being honest with ourselves, it might be your technique. Check each fret in this way to ensure a clean-playing instrument.

■ **Step five:** finally, check the moving parts. See that the tuners work smoothly and accurately and that the controls do what they're supposed to and don't have any graininess or stickiness to their movement. A common fault is for the control potentiometers to crackle when turned. This may require a squirt of special pot cleaner, or replacement. If it's a new instrument, you'll be insisting on a different model or replacement.

MAKING A DEAL

Having done all five checks in the system – acoustic, finish, action, frets, moving parts – you may celebrate by playing the bass for a few more minutes. Not bad, is it? If there are any shortcomings thrown up by the checks, bring them to the attention of whoever is trying to sell the instrument to you, be it store or private seller. A store should agree to put right anything obviously wrong. A private seller might knock off some money if something's not quite up to scratch, assuming that you're persuasive enough to convince them that this is the case.

Whether you're buying in a store, in a rehearsal room or at someone's house, it can help if you have someone with you who's a bass player, or at least another musician who's parted with money for an instrument before. Even if they say nothing, but you just know they're there, it can be a real comfort. And definitely worth a drink afterwards. It can also be useful, especially if you're buying used, to have cash with you if possible. It can get you a better price. If you've only once been on the receiving end of the look-at-this-money trick, you'll know how tempting a fistful of notes can be. And the old storekeeper's phrase "discount for cash" still applies. Money talks – so make sure you're heard.

In the store, don't get flash or start showing off – you're checking out the bass, not the salesman's knowledge of hip bass-player CDs. It's a good idea to test on an amp which is the same as (or similar to) your own or one you know, if conditions allow: don't get engrossed in the graphics and compressors of outrageous amps, however tempting. Just get a decent sound and concentrate on the bass.

Consider resale potential. This unknown brand may be an absolute bargain, but what happens when you want to move on to a better bass in the future and therefore need to sell this one? Check out some ads and see which used brands are popular and what the prices are like – you might expect a used bass to go for around 60-70 per cent of its new price. Think about this: the used price of a bass often stays at that level whether third- or tenth-hand, whereas a new bass almost always depreciates in value.

In the end, of course, if you like a bass enough, then go for it whatever the name on the head. You may start a trend – though it's unlikely. Bear in mind that your style may change or the type of music you play may change – and how versatile or appropriate is the bass you're thinking of buying? Go for simplicity, but try also to think ahead.

Remember that just because a certain bass is more expensive than another, that does not necessarily mean that it's better. Pricing of new basses can seem to work in a

mysterious way; fashion and the desirability of certain brand names can be just as big a factor in the price of a bass as the cost of production and the relative attention to detail. Either way, you won't get a bass these days for much under £125/$200 – and you can pay £1250/$2,000 or more for a new bass if you want. Remember that a £600 bass might suit your playing and style better than a £1,800 bass – and that the £1,800 bass won't necessarily be three times as good as the £600 one.

If you're thinking of spending a lot of money then you should also consider getting a bass maker to build you an instrument, to your requirements. Perhaps there's a maker locally whom you've heard about and whose work you may have seen and, with luck, tried? On the plus side, a handsome bass will be built to your own specifications, and should in theory be an absolutely ideal instrument. It's also very satisfying to watch your own plans change into a real instrument, stage by stage. On the debit side, if and when you want to buy something new, it may prove hard to sell such a personal instrument; and if you don't have a very clear idea of exactly what sort of bass you want when you go to a maker, you may end up with an instrument that even you don't like. So consider the handmade option, but consider it carefully.

Whatever sort of bass you're looking for, it's always a good idea to try as many basses as you can. If a casual acquaintance in another local band has a type of bass you've never tried, find some way of getting a go on it. If the local store has a new delivery of brand new basses, or has a batch of used stock just in, get in there, chat with the salesmen, and try them. If there's a music fair on near you, or a store is holding an open evening for a particular manufacturer, get down there and try out the basses. Don't rely solely on rumours, reviews and the prejudices of other players – find out for yourself what these basses are like.

That's not to say that the opinions of others are not important. It's worth listening to what bassists have to say – either directly or in books and magazine interviews – and it's especially useful to hear the views of experienced players who have been through a lot of basses. But remember that a few bassists appear in endorsement ads without intending to play an instrument exclusively, and that pros' stage and studio basses are occasionally worked on and modified, sometimes to the extent that the bass may not sound much like a stock instrument.

BUYING USED

When you're buying a used bass – usually through a classified ad, via the internet auction sites, or in the local store – you have to exercise extra vigilance. People have been known to abuse and neglect basses – and then sell them. So in addition to our famous five checks for new basses, all of which obviously still apply to used basses, it's worth bearing in mind a few extra checks for these instruments.

Listen for crackles when you play the bass through an amp – fiddle with the controls and listen carefully. Keep your ears open for cutting-out pickups, and ensure you're getting equal volume from each string. Any unwanted noise in this area indicates dodgy wiring or worn-out components inside. If you're faced with a bass with two or more pickups and aren't sure whether all the pickups are working, hold a vibrating tuning fork over each

and listen for an amplified note from the speaker. You don't have a tuning fork? Try gently tapping the pickup.

A tuner can be a useful object to take along to test a used bass. Make sure the bass is at concert pitch. If the seller is demonstrating it with slackened strings, he or she may be trying to hide something.

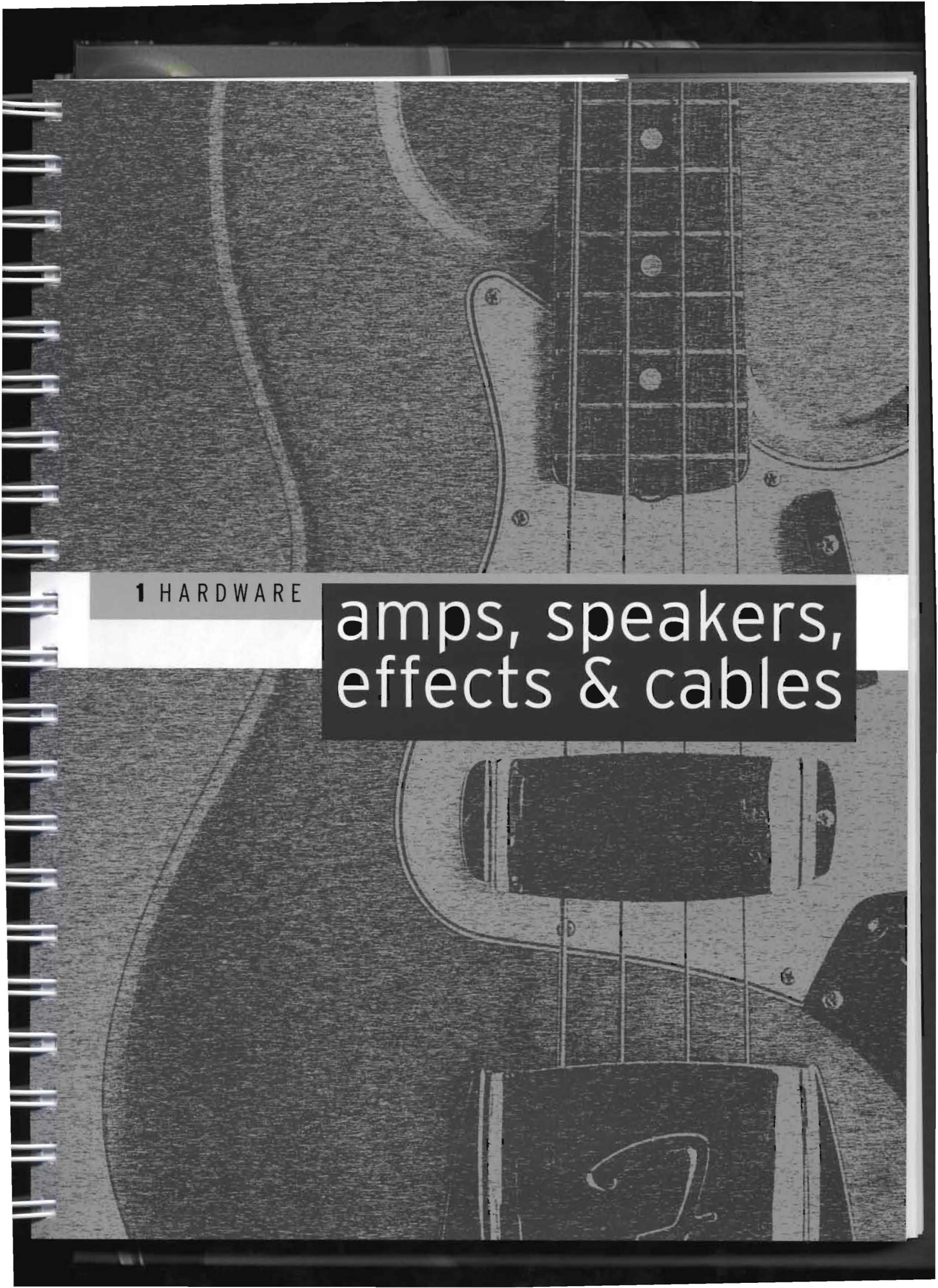
Screws are good clues to the general condition of a used bass and how well or badly it's been treated. First, are they all there? Check especially for missing screws on the tuners (they'll soon pull away and affect tuning accuracy) and check that there is a full complement of screws on the pickguard and pickup surrounds. Second, check the condition of the existing screws. Have they been burred down and made next to useless? This indicates a careless owner rather than a fatal error. But it implies that other, unseen things could be wonky, too.

'Sight' the neck to check it for warping and twists (See Maintenance, p64.) While some faults in an instrument can make great bargaining points, some are potentially bad enough to render the bass useless for any meaningful performance. Neck twists in a bolt-on model are cause for great concern, but may be cured with a replacement neck or extreme luthier surgery. Problems in a through-neck body instrument are a reason to walk away. The entire instrument now has a value of the removable components on it as spares and no more.

Modifications, usually known as 'mods', might be there to make the bass look nicer – or they might be there to hide something. There is a legendary example of a bass that went into a 'top repair workshop' to have the neck shaved down. Back it came suitably shaved, and with an extra stripe painted along the back of the neck (not asked for). How pretty, thought the owner – until the truss rod, carelessly exposed by the shaving and 'hidden' by the new stripe, gradually edged its way out of the back of the neck. Be careful.

Finally, if you're at all unsure, then wait. Of course it's tempting to spend now: you've made the visit to the store and here you are with the bass in your hands. Or you've gone through all the trouble of ringing up someone from an ad and here you are at their place. You're itching to own a bass. But be patient.

Are you sure you're absolutely satisfied? There are plenty more basses, but you've only got so much money. Don't let the store or advertiser talk you around if you're not entirely sure. Don't be intimidated by the seller. In the case of stores, return to those that are good, and tell useless ones why you won't be coming back. After all this checking out of feel and quality, you're probably a bit tired. So have a quick rest. Now that you've got yourself a decent bass at a good price, the fun is only just beginning.



1 HARDWARE

amps, speakers, effects & cables

Bass amplification is often relegated to second place in discussions of a player's tone. The actual instrument, the pickups, strings, and even cables often get more attention than the bass amplifier. Hardly surprising then that many a bassist's live experience is one of frustration and disappointment. But help is at hand ...

OVERVIEW

The aim is simple; to make the instrument loud enough to be heard over the rest of the band. "The rest of the band," will determine a lot of factors when considering a bass amplifier. A folk band without a drummer will probably demand a different bass amp to a rock player in a stadium. Bass amplifiers can be divided into two categories; the combo, a self contained unit containing the amplifier and speaker; or a bass rig (or stack) consisting of a separate head and cabinet(s). The amplifier part of the rig can be further subdivided into the gain and tone-shaping section, the preamplifier, and the power stage, the power amplifier. These items can be purchased separately (although one won't produce a live sound without the other). More often than not the preamp and power amp are combined into one unit, often referred to as a bass head.

The second incarnation of the Fender Bassman, created in 1954, proved more successful as an amp for lead guitar.

HISTORY

If we take Fender's 1951 Precision Bass as the starting point of the first production electric bass, then it should come as no surprise that Fender also offered a bass amp to be used with their new invention. The Fender Bassman was that amp, a 1 x 15" combo powered by two 6L6 valves (vacuum tubes) pumping out a modest 26 watts. This 1951 design was marketed together with the new Precision Bass and good examples of each today fetch a small fortune. The amp was soon found to be struggling with the new lower frequencies players developed, and upgrades to 40 watts and four 10" speakers came in 1954. Ironically the Bassman eventually found respect as one of the greatest lead guitar amplifiers ever built, its tube drive and warm tones suiting the sounds of the electric guitar. Guitarists pushed their amps into loud and increasingly popular distortion, but bass players sought ever-increasing levels of clarity and power.

Everett Hull, a Chicago-based musician and inventor of the Amplified Peg design, a microphone unit that operated inside an upright bass and attached to the bass's peg support, was keen to offer an amplifier with his new invention. A collaboration with electrical engineer Stanley Michael saw the production of the Michael-Hull Electronics Labs Bassamp, a 1 x 12" combo powered by twin 6L6 valves and pumping out 18 watts into a single 12" speaker. It preceded the Fender Bassman by four years. Hull was later to rename his company, following Michael's departure, as The Ampeg Bass Company, and the brand Ampeg has to this day been more closely associated with amplification for bass rather than lead guitar.

Over in the UK, Tom Jennings and Dick Denney had slowly developed and refined their Vox AC (Amplifier Combination) model amplifiers, boosting output up to 15 watts.

The Shadows, whose bassist Jet Harris was an early user of the Vox AC30 combo. This was another amp that came into its own when used by guitarists.

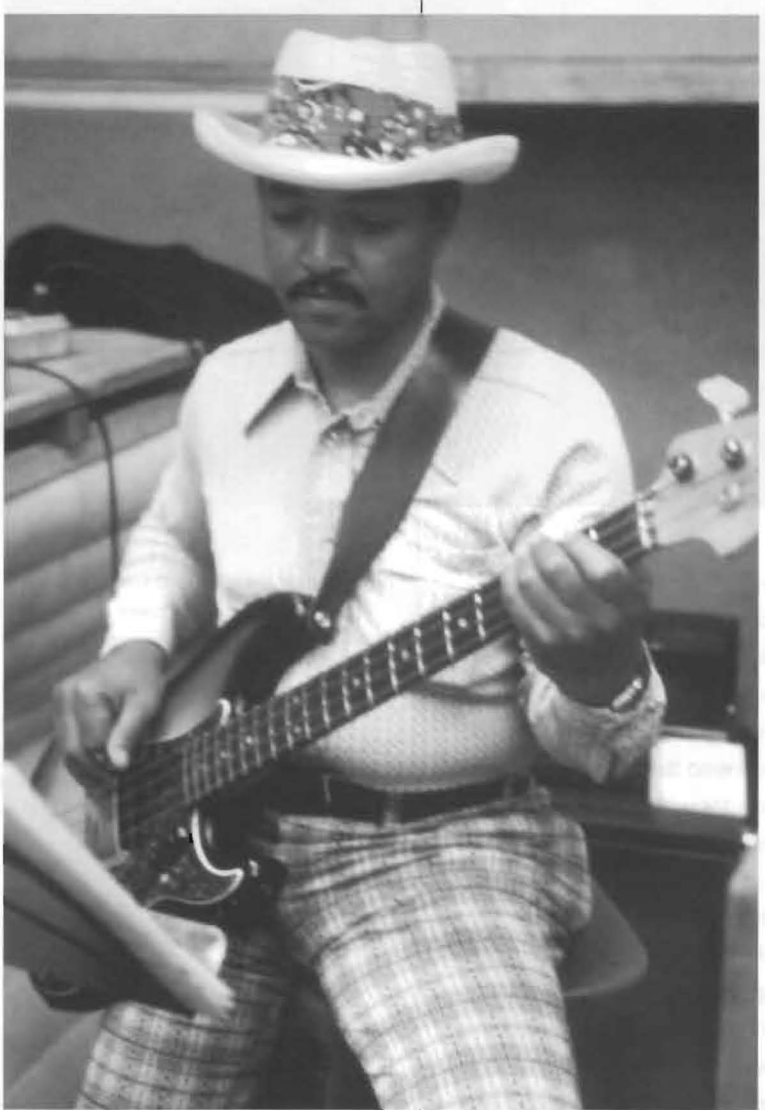
Early interest came from The Shadows, led by Hank Marvin, but the amplifier was soon deemed too quiet for the volume levels bands required. Denning boosted power up to 30 watts, using a quartet of EL84 valves, and incorporated twin 12" speakers for a fuller sound. Bassist Jet Harris found the combo suitable for bass, especially when using the earlier versions equipped with Goodmans Audiom 60 speakers. Thus was born the AC30, although once again, like the Fender Bassman, it was an amp that would be praised by guitarists for generations to come rather than the bassists for whom it had also been intended. Back in the US, however, the newly incorporated Ampeg Company was readying a new bass amp.

By the late 1950s, Leo Fender was already on his third version of the Precision Bass, Gibson had launched its violin-like Electric Bass, Rickenbacker was selling its 4000 model bass and Hofner, Danelectro, and Framus had joined the party. Ampeg had refined and tweaked its Bassamp, but it was clear something new was required. Ampeg delivered; the Portaflex combo, designed by Jess Oliver, was a revolutionary amp. It incorporated many new design features, such as a ported, closed-back cabinet for full bass response, a flip-

top head that disappeared like a vintage sewing machine back into the top of the cabinet when not in use, and a dolly to ease moving the combo around. Conservatively rated at 25 watts from its two 6L6 tubes, its design gave bassists more of the low-end and projection they'd been missing from previous designs. One cool feature of the Portaflex was its light-up Lucite panel, which sent out a soft green glow with the Ampeg logo clearly visible in the dim lights of the stage. For an extra $50 you could ask the factory to engrave your own name on the amp. Motown session bassist James Jamerson put the Ampeg Portaflex firmly on the map by employing it on hundreds of great Motown recordings, and its success continues, with several re-issues emerging in recent times. Mike Mills has used a Portaflex on live work with REM on occasions.

By the early 1960s, musical changes were clearly pushing manufacturers to create better amplification. Back in the UK, nowhere was that more obvious than in Vox's relationship with The Beatles. After requesting a loan of some AC30s the band's manager, Brian Epstein, promised that the band would use only Vox equipment. With the AC30 clearly unsuitable for bass guitar in front of hordes of screaming teenagers, Vox soon developed the T60 Bass Amplifier, notable for its 60-watt output, transistor design and substantial cabinet consisting of a 15" and a 12" speaker in combination. For the band's early 1960s UK tours, Paul McCartney used a T60 cabinet matched to an updated EL84-powered AC50 when some reliability problems were reported on the solid-state T60 amp. Solid-state devices were in their early years and a bigger AC100 combination helped Paul McCartney deliver his basslines to thousands of adoring fans across the US for the band's 1965 tour. So with the arrival of 100 watt amps, bassists were finally starting to get the sort of power they really needed, but cabinet design seemed slow in following suit.

James Jamerson, bassist behind most of Motown's great hits of the 1960s, was a fan of the Ampex Portaflex amp.



Fender's bass amps also employed solid-state technology during the 1960s and these, like the Vox T60 appeared to be both poor sounding and unreliable. A return to form was achieved with the 'silverface' Bassman range, so called because the control panel was now finished in a bright silver finish to reflect the space age decade. These were valve-powered amplifier heads with an output ranging from 50 to 135 watts but what made them appealing to bands were the cabinets that accompanied the amplifiers, such as the 2 x 15" model.

Stadium rock and roll pushed amp designers even further into producing dedicated bass amps and it was Ampeg which delivered yet another archetypal bass amp design with its SVT (Super Vacuum Tube) 300-watt head and 8 x 10" cab. Early prototypes were rolled into The Rolling Stones' rehearsal studios in 1969 and rolled

straight out onto the road weeks later. A legend had been born. The same rig in tweaked format still exists today and it would probably be fair to say that any decent size stage for a rock and roll event has probably had an Ampeg SVT delivering the bottom-end at some point during its history.

Two amplifier companies destined to be associated with stadium rock emerged in the 1970s: Acoustic and Sunn. The Acoustic 360 amplifier was enjoyed by both rockers (John Paul Jones) and jazzers (Jaco Pastorius) alike. Often linked to a folded-horn style cabinet, the 360 was usually linked via a slave output into further powered cabs or additional heads to give the output required for these stadium shows.

Sunn was an amplifier line developed by the Sundholm brothers. Conrad Sundholm was an electronics engineer who answered his brother Norman's plea for a better bass amplifier, especially as Norman's band, The Kingsmen, now had a hit with the tune 'Louie Louie' and were performing to larger audiences. The result was the birth of Sunn amplifiers. The appropriately named Coliseum 300 was a favourite of the Woodstock scene, together with the ported 2 x 15" cabinet Conrad designed to go with the amplifier. The important development here was the arrival of bass-specific models, not just lightly modified versions of guitar amps.

Other companies persevered with delivering bigger versions of their existing line-ups, notably Marshall with its Model 1969 Marshall Major 200-watt head and Hiwatt with the 200DR. Valves still ruled in these amps, and service costs must have sky-rocketed as power and preamp tubes ran into dozens per amp. 1970s rock was the market for these valve giants, with the likes of John Entwistle, Jack Bruce, Geezer Butler, and Noel Redding all making good use of several such brands. But the day of the all-valve rig was about to see another serious challenge from a most unlikely source, involving the percussive thumping of strings.

The 1980s saw the emergence of slap bass, a style that originated with Larry Graham in the 1960s. The technique involved hitting the strings in a percussive way, creating pulsating rhythmic beats, and it was soon taken to new levels by a number of players, including Stanley Clarke in the US and Mark King in the UK. This new style was not kind to valve amplifiers, as the transients and dynamics punished the slow-reacting speakers and drove the tubes into distortion, a sound no potential slap enthusiast wanted to hear. A plethora of manufacturers soon turned their attentions to this new phenomenon including Gallien Krueger, SWR, Eden, and Trace Elliot. One common denominator amongst them was the rejection of the valve power stage, replacing it instead with solid-state devices to ensure even greater power handling and headroom. Another common decision was to produce only bass amps, or at least to make lead guitar a specialist side product. This was a clear indication of the new popularity of bass guitar. Cabinet design also moved with the times, and large, deep cabinets were often replaced by cabinets sporting multiple small drivers such as Trace Elliot's 4 x 10", which is now seen as an industry standard and offered by virtually every manufacturer of bass cabinets.

The classic stack of many a bass player now consisted of a 4 x 10" cabinet stacked on top of a 1 x 15" cabinet. Trace Elliot even offered a further stack option called a Bright Box consisting of four 5" speakers designed to sit on top of the 4 x 10". Gallien Krueger's successful 800 RB took another view of this concept, offering an amplifier with two power stages inside the head unit. An output of 300 watts was delivered to the lows,

The legendary Ampeg SVT head amp.

A selection of Marshall speaker cabinets from a 1960s catalogue. The line-up includes a 1 x 18" bass cabinet.

while a separate 100-watt amp took care of the highs. A front mounted adjustable crossover let the player decide where that high/low balance lay. The result was a powerful yet clean sound. Flea loved them and continues to use Gallien Krueger to this day. Bass was booming, quite literally, everywhere. Hartke developed the aluminium speaker as an alternative to the paper cone that had been used since the first amplifiers. The visually stunning drivers were claimed to offer instant response to the player's dynamics, an important part of the slap and tapping techniques. The late, great Jaco Pastorius took delivery of an 8 x 10" Hartke in 1984, and tapping expert Stu Hamm was closely associated with Hartke during his career. Hartke currently is also the pick of many rock players such as Jack Bruce who used the amps for his Cream reunion tours.

Players who loved the clarity of their new solid-state designs would occasionally secretly lust after some of the warmth and grind that the old valve heads offered, and it didn't take long for the hybrid bass amplifier to appear. Consisting of a valve preamp driving a solid-state power amp (often using MOSFET technology), it claimed all the warmth and some of the grind of a tube head but with more reliability and much lower service costs. Designer Steve Rabe endorsed this principle in his SWR SM-400 featuring a 12AX7-driven front-end together with two 200-watt power amps, a crossover section and a built-in limiter. By the late 1980s, bass amplification had to be powerful and sophisticated; after all it had a new challenge to deal with, the five- and six-string bass.

The extended frequency range of these low-B and high-C instruments made extraordinary demands on bass amplification. It would be fair to say that, unlike the requirement for increased headroom and fidelity in the 1960s, this challenge is still being met today. Many boutique bass companies have applied 'no expense spared' principles to designing their bass amplification. Aguilar adopted a modular rack approach to maximise quality, utilising sophisticated tube preamps and valve power amps in a quest to blend vintage warmth and modern headroom. The result was the DB680 preamp and DB728 power amp featuring no less than eight 6550 power valves. Phil Jones Bass has adopted a policy similar to Ampeg's with its 8 x 10", using numerous small drivers in each cabinet – in this case up to 24 (yes, 24) 5" speakers. Companies such as US-based Bergantino take a similar 'boutique' approach to their loudspeakers, leaving amplification out of the equation. Imagine that in the 1960s; a company specialising only in bass cabinets.

The new millennium has seen another revolution in music – the internet. Whilst not impacting on design itself, the Internet has affected market forces in terms of pricing, and coincided with global co-operation with manufacturing facilities in the Far East. The result is a cost benefit to the new player, who can now secure a powerful bass rig or combo for a fraction of what it would have cost a decade ago.

Hartke, SWR, Warwick, Eden, and many others now offer affordable budget versions of their high-end brothers through offshore manufacturing. This period has also seen a period of brand buy-ups by many companies keen to maintain a high profile in all music markets, hence Fender's purchase of SWR, US Music's of Eden, and Peavey's of Trace Elliot.

New technologies and reduced pricing of exotic raw materials led to new developments in loudspeaker design, incorporating the lighter neodymium magnet. Combined with new cabinet-bracing technology, this has allowed the availability of large powerful cabinets vastly reduced in weight. Italian manufacturer Mark Bass uses

neodymium drivers extensively and its 4 x 10" HR cabinet weighs a mere 56 lb/25kg. Although some players feel the neodymium speaker still needs some more development, it clearly represents the future. A cheaper, louder, lighter bass rig? It's here now.

AMPLIFIER FORMATS

Combos

Bass combos are a combination of amplifier and speaker. Providing you have a mains/AC supply plug, you are ready to perform. Combos currently offer the player the widest choice in amplification. A combo could be a small affordable practice amp of just 15 watts and a single 8" speaker designed to suit a beginner for use in the bedroom, or it could be a flight-cased monster of 500 watts with 4 x 10" speakers ready for touring duties. Assessing your needs will often depend on budget and requirements. You can certainly practice through a high-end powerful combo in the bedroom but you will struggle to reach performance levels from a small, low-powered combo. See Bass Loudspeakers: How Much Power? (p97) for more information on what is reasonably required in a performance situation.

Combos can therefore cover many options. Smaller practice or low-power options (up to 75 watts) will usually feature smaller speakers of anywhere between 6" and 12". Features may be limited and consist of simple tone controls and a single gain/volume control. Most makers offer these in their line-up. The Peavey Max 112 and Max 115 are typical examples.

Some combos offer the ability to tilt back to project the bass sound towards the players ear. The Hartke B600 is a good example in this range, although its 120-watt Kickback series offers the same option with gigging levels of output. The mid-priced (and sized) combo offers the greatest choice to bass players. The player has dozens of competitively-priced choices. Speaker configurations may be single 1 x 15" (Laney R4), 2 x 10" (Eden Nemesis NSP210) or even 4 x 10" (Hartke VX3500). Power outputs can range from a simple 100 watts (Roland Cube 100) to a heady bi-amped 510 watts (Gallien Krueger 1001RBII/115). And preamp choice is vast too. From simple tone controls (SWR LA100) to powerful graphic equalisers (Trace Elliot 1215) or even built-in effects (Ampeg BA210 SP) there is a combo to suit.

Many professional players like the concept of an all in one unit to cope with the demands of studio work. The requirements now are for excellent quality and useful features. One such amp is the SWR Redhead, a 350-watt amplifier designed for ease of use in the studio, with facilities that include front-mounted DI out, 2 x 10" plus horn configuration, tube preamp, limiter, tuner out and a panel that unclips from the front (to protect the speakers in transit) allowing the combo to be tilted up to the player for clarity of tone during those gruelling sight-reading sessions. Clearly an amp designed by bass players, the Redhead is considered by many to be the modern equivalent of the Portaflex.

Mesa Boogie introduced its Walkabout Scout with similar ideas. With 330 watts of power driving a 12" speaker, which in turn moves air on a passive radiator driver, it shows that portability and power are still in demand with many players.

Bass amplifiers

Most bass heads tend to offer power outputs exceeding 100 watts. Peavey's Pro 1600 currently tops the charts with its incredible 1,600 watts of power. For most semi-pro players though, somewhere between 250 and 500 watts is sufficient. Features can vary enormously and, if that isn't confusing enough, many brands do have particular sounds as their trademark, whether the manufacturer admits that or not. Some heads stick with just basic gain and tone controls whilst others add built-in effects, crossovers and bi-amping power stages. Design of the tone shaping and output can be solid-state, valve or a combination of both called hybrid (nearly always valve preamp and solid-state power stages). All-valve designs are rare, although Ampeg's famous SVT is still available as the SVT Classic (see Bass Amplification: History, p78). Pumping out 300 watts minimum, it includes no fewer than six 6550 power tubes and two 12AX7 preamp tubes. Its EQ is surprisingly simple: bass, middle, mid frequency, and treble controls. Heavy, solid and with potentially high maintenance costs it still is a common sight for professional bassists today. Other all-valve designs include the Mesa Boogie Bass 400+ with a frightening twelve 6L6 power tubes outputting 500 watts of bass power. Both companies offer alternatives to the all valve design, Ampeg with its hybrid (SVT-PRO) and solid-state (B-series) models, Mesa Boogie with its M-Pulse Range.

Trace Elliot has favoured the solid-state or hybrid design approach (although it also offered all-valve designs too). Its 11- and 12-band graphic EQ sections have become legendary and are often copied. The latest design offers a choice of 500-watt mono or 1,000-watt stereo power stages coupled to a hybrid preamp containing dual band compression, 12-band EQ and a cool front panel that lights up with a fluorescent green glow.

Ashdown has combined both standard EQ and graphic equalisation on its EVO range of bass heads. Bass, middle, and treble controls are supplemented by two pairs of additional EQ bands on sliders. Unusually, the EQ section can be completely bypassed via a front panel button allowing the player to compare flat response and tweaked tones. An onboard Octaver is also incorporated. Euphonic Audio employs a rotary cut/boost control with a slider frequency control on its iAmp 350 head.

Manufacturers often offer a range to suit budgets and tonal preferences. Hartke's HA range is available with a valve preamp, ten-band graphic, and compressor stage, or as a more affordable solid-state design with standard four-band EQ and without compression.

Although slightly more complex, the parametric EQ option allows wide ranging tonal alterations for the bassist. Usually a semi-parametric EQ, comprising a cut/boost control and a frequency control (to select the frequency you wish to adjust), is more than enough to cover most situations. Eden's WT (World Tour) Series favours this approach, as does Fender with its Pro Series heads. Fully parametric EQ adds a further control, often labelled Q. Like the mysterious James Bond scientist, Q controls cause great confusion amongst players; essentially it is used to control whether the band of tones altered is wide or narrow (See Bass Amplification: The Works, p86). The facility may also be called a bandwidth control. Narrowband filters are also often referred to as notch filters. Peavey's Pro 500 and 1600 offer fully parametric EQ, a rarity these days.

Some bass heads offer built-in effects, the most common of which is compression or limiting. Be aware of the capabilities offered. Some are simple output protection devices activated by an on-off switch (Peavey's DDT system, found on all its models), others a

single compression control to adjust compression ratio (Hartke HA3500) or a complex studio-based compression (Trace Elliot AH1000-12 and Mesa Boogie M-Pulse 600). SWR has favoured the limiter, as found on its range-topping SM-900. One should remember that compressors can be purchased separately, their inclusion not being deemed necessary at all by many makers.

Bi-amping can be achieved when two power stages are provided. Stereo bass heads include the Hartke HA7000, SWR SM900, Trace Elliot AH1000-12, Ampeg SVT-5PRO, and Gallien Krueger 700RB. Bi-amping allows one power amp to drive one cabinet designed for low-end signals and the other to drive a second cabinet intended for mid and high-end signals. The frequency at which this occurs is set by the crossover control. A further level or balance control adjusts the amount of power sent to each cabinet. The end result is a very pure tone of a hi-fi like quality, although cabinet choice is critical as most cabs are tailored for full-range signals. Gallien Krueger offers bi-amping in a very different manner to most. Although its revolutionary 800RB used the system above, the latest amps have one power amp delivering low-end to the main drivers whilst the second power amp, with a much lower output of just 50 watts, delivers high-end to the bullet tweeters only. This is bi-amping on similar principles to hi-fi systems and requires the use of Gallien Krueger's own RBH cabinets for its full effect plus the use of Speakon cabling.

Some amps are loaded with features. The digital world has certainly allowed more features to be crammed into one amp. Whether or not bassists choose to take that route remains to be seen. The SWR Mo'Bass employs a 900-watt mono/400-watt stereo power stage, analogue effects including a bass synth, chorus, overdrive, and octaver, and an 11-button footswitch to control the end results. The Peavey BAM 500 head utilises digital modelling technology to give the bassist an amp with effects (everything you'd ever realistically need) and the ability to mimic the set-up of other amplifiers and cabinets. Again a multi-function footswitch takes care of storing and selecting these options at will.

Rack systems

Rack systems divide the amplifier head into its two main stages, the preamplifier and the power amplifier. Often, when sold in this separate format, the components have the ability to be rack-mounted. Rack mounting consist of bolting the rack ears to a separate rack case fitted with moveable, recessed, captive nuts. It has become, however, a broad generalisation. Many amps are offered as rack mounting units even though they consist of a complete amplifier, ie, both preamp and power amplifier in one unit. And a separate system of preamp and power amp need not be rack mountable at all. The preamplifier could be something as simple as a portable DI box with EQ, such as a SansAmp Bass Driver DI, linked into a power amp sitting in a wooden sleeve. This section however considers the most common type of rack system that splits the preamp and power stages into separate units.

The advantages of rack systems is obvious; greater choice in mixing components (a simple preamp with a mega-powerful amp or a complex preamp with a low power stage), flexibility in mixing manufacturers (eg, Gallien Krueger preamp with Crown power amp), the chance to massively increase output by linking power stages (hence the use of the system by touring professionals) and opportunities for bi-amping or even tri-amping.

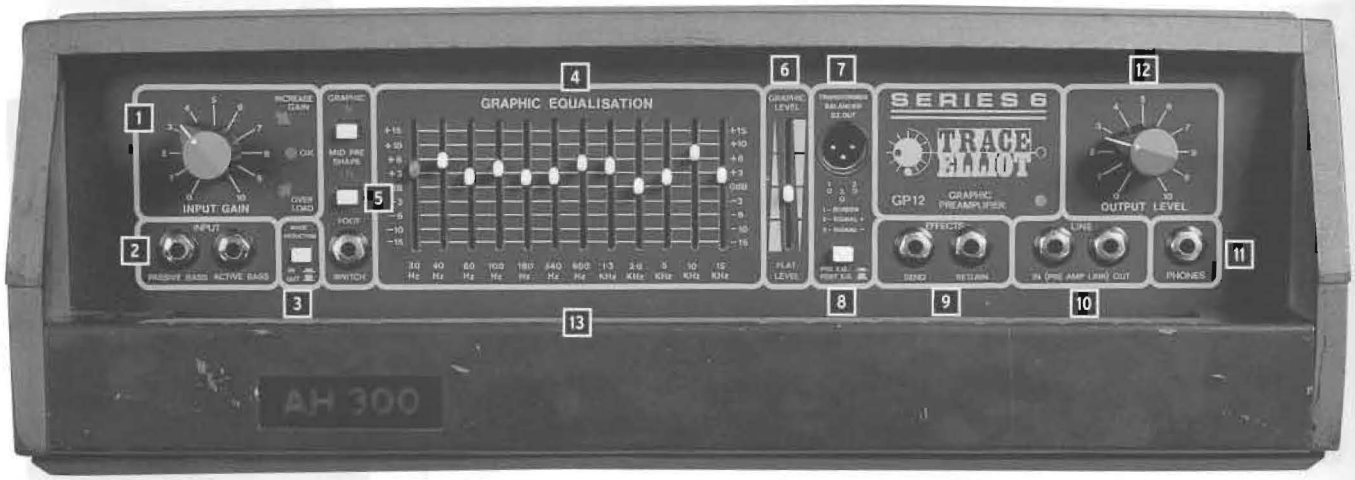
The 'silver-face' Fender Bassman head amp, introduced in 1968, with a speaker cabinet from the same era.

THE WORKS

Trace Elliot Series 6

This used, 300-watt amplifier head exhibits many features found on most amplifiers today. It labels its preamp separately, as it was available as a separate preamp or, as in this case, a ready to roll (and rock) all-in-one head unit.

Front panel



1 INPUT GAIN CONTROL
This control sets the gain level so that the input can accommodate a wide range of instruments, each of which will have its own specific output. Passive basses are normally low in output compared to active basses and may require higher gain settings. Visual indicators help the user find the optimal setting. Some amps offer a simple Clip LED. Here three stages show insufficient gain (Increase Gain), excessive gain (Overload) and ideal gain (OK).

2 INPUTS
Because the output range of most instruments exceeds the range of most gain controls, dual inputs are offered on the amplifier. This is not necessarily to accommodate two basses; in fact some amps will cut the second jack if this occurs, but to allow a working range in output for excessively quiet or loud instruments. Further fine-tuning can then be achieved with the gain control. An alternative is the signal input system with a dB pad button.

3 NOISE REDUCTION
An unusual option; it offers a reduction in high-end when using noisy effects processors or active electronics. It is rarely found on amplifiers today.

4 GRAPHIC EQ
Operated by a front button or via a footswitch, the 12-band graphic EQ can cut or boost up to 12 separate bands of EQ ranging from a high of 15kHz to a low of 30Hz to cater for the fundamentals of a low B-string on five-string bass. It's called a graphic EQ because it offers a graphic visualisation of the resulting tone. Here the mid-range EQ is set out in a classic setting often called the 'smiley face' for obvious reasons. The resulting sound is a sharp reduction in mid-range with plenty of lows and highs. The sound is apparent before plucking a single note thanks to the 'graphic' nature of the EQ.

5 MID PRE-SHAPE
Activating this button kicks in a preset EQ; in this case, reduced mids but extra highs and lows. An alternative is the variable pre-shape; the Aural Enhancer on SWR amplifiers, Contour on Peavey and Shape control on Hartke models. Similar in operation to the preshape, it can cut and boost various frequencies. This time the frequencies are varied according to the setting of the rotary control, thereby offering a more flexible alternative to a simple on/off preset. Some controls work in reverse, offering a flat response at the end of their travel and a tweaked EQ at the beginning.

6 GRAPHIC LEVEL
Boosting frequencies can raise volume levels just as cutting them can decrease overall levels. The level control allows the graphic settings to be boosted or cut to match (or otherwise) the normal level.

7 DI OUT
The DI (direct injection) out facility (or XLR out, named after the type of connector required) allows a signal to pass from the amplifier straight into a mixing desk of a PA system or recording studio. This saves using a microphone on the bass cabinet, where other sound sources can be picked up. XLR DIs are normally always balanced, which greatly reduces noise levels. Some amps offer unbalanced signal DI outputs that are useful, but inferior to balanced ones.

8 PRE EQ/POST EQ
This option allows the player (or sound engineer) to choose whether the direct inject signal is delivered before (Pre) the equalisation stage or after (Post) it. Some amps will also offer a DI level control.

9 EFFECTS LOOP
An area of common confusion, the effects loop allows the patching of effects into the amplifier instead of using them between the bass and the amp's input. The jacks are labelled Send and Return. The send jack sends your bass signal out of the amplifier and into the input of an effects processor; the return jack returns the signal to the amp from the output of the effect. Effects loops aren't always used for all effects. Some stompboxes work more effectively through the input.

10 LINE IN/OUT
These jacks allow the option to patch in a different preamp while using the amp's power stage (Line In), or to send the amp's preamp signal to another power amp (Line Out). Other terms used for these functions include Power Amp In and Preamp Out.

11 PHONES
Connect a set of headphones here. Some units will mute the output when phones are connected, thereby allowing silent practicing. Other amplifiers feature a Mute switch giving the option of silent or outputted bass, which can be useful in recording situations.

12 OUTPUT LEVEL
Also known as master volume, this determines the amplifier's final volume.

13 UV LIGHT
Illuminating parts of the amplifier in a cool look-at-me way was in fact first adopted by Ampeg (see Bass Amplification: History, p78). Here, Trace Elliot uses an ultra violet fluorescent tube in front of the control panel to create extra lighting in dim stage conditions. Most manufacturers use rear panel illuminations for functions requiring status indication.

Rear panel

Functions are kept at the minimum here, as is typical of older or new budget amplifiers.

1 MAINS SUPPLY
The on/off switch, here backlit in green.

2 VOLTAGE
Also often marked AC in. A cable is inserted here to connect to the mains power. Some amps have hard-wired mains cables that can't be detached, and a few, such as Fender's Pro 800 model, may even have different connectors to accept high current-draw power cables.

3 MAINS FUSE
To protect the amplifier in the event of a problem. Here the fuse value is written next to the holder. T4A = time lag type fuse.

4 SPEAKER OUTPUTS
A standard jack or XLR output is offered. Speaker cable must be used; not standard instrument cable (see Cables, p108).

5 FAN
Most bass heads will feature a cooling fan to keep components cool and prevent early failure. Some fans can be switched off for silent studio use, or are heat-sensitive, speeding up when conditions demand. Some modern designs do away with the cooling fan itself, the Ampeg Portabass PB250 for instance.

6 ULTRA VIOLET
Activates the front UV light.

Peavey ProBass500

This recent amp exhibits some of the alternative types of EQ, inputs, and back panel features found on bass amplification in the mid to high-end market.

1 MUTE
Silences the output from the amplifier. Useful for tuning up silently and for preventing potentially damaging input noise when plugging in an instrument.

2 INPUT
A single jack has a Pad to reduce the gain for high output active basses. In this case the reduction is -10dB. This dB cut value is often shown next to the switch; for example, Ampeg's pad button offers a -15dB cut.

3 HI BOOST
A simple switch gives an extra 8dB boost at 5.5kHz

4 LOW CUT
Also called a Bass roll-off switch, it reduces frequencies by -3dB at 125Hz; useful for reducing rumble in an acoustic or five-string bass.

5 PREGAIN
The Pregain control is linked to a valve, a 12AX7, to provide extra warmth, and, in this case with the Post gain control, the option of an aggressive distorted sound.

6 POSTGAIN
Sets the level of the distorted tone.

7 LOW
The most common type of EQ is known as shelving EQ. A simple rotary control allows cut or boost of a fixed frequency determined by the manufacturer.

8 HIGH
Another shelving type EQ, with its frequency affecting the treble range.

9 CONTOUR
A single control that simultaneously boosts and cuts a set of pre-determined frequencies, in this case a boost of 4dB at 35Hz, a cut of 30dB at 400Hz, and a boost of 4dB at 5.5kHz when set fully clockwise.

10 PARAMETRIC EQ
Unusually, this amplifier offers a full parametric system. Three bands are offered allowing the user to select three frequency ranges to adjust. The Frequency control shows the range of adjustment available on each band.

11 DDT
Peavey's output protection circuit can be bypassed for increased dynamics but with the possibility of speaker damage in extreme conditions.

Rear panel

As is typical of many modern systems, the ProBass 500's rear panel has many additional features.

1 SPEAKER OUTPUTS
Here jack and Speakon (see Cables, p108) connectors are offered.

2 POWER AMP IN/PRE-AMP OUT
Note the different name and location of these features on the rear panel compared to our previous bass head example.

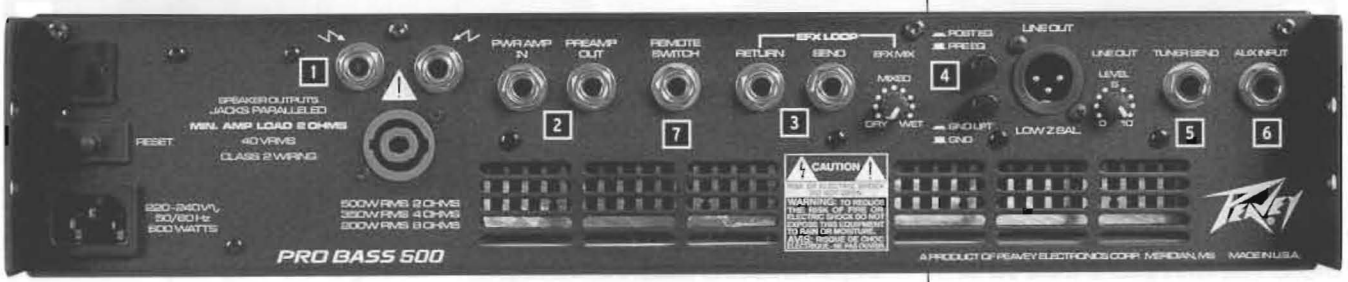
3 EFX LOOP
This loop is a parallel effects loop, allowing the addition of a control that can adjust the mix of dry and wet signals.

4 POST EQ/PRE EQ
This is linked to the Line out XLR jack and allows the user to select if the signal is sent out from the amplifier before or after EQ and effects treatment. Here an additional Level control is added to allow adjustment of the output from the Line out.

5 TUNER SEND
Plug your guitar tuner in here! The Tuner send allows a signal to be sent to an instrument tuner that is separated from the main signal chain. This prevents the severe loss of tone that can occur when using your tuner n front of the input stage.

6 AUX INPUT
Allows you to use a rear-access jack input instead of one on the front panel.

7 REMOTE SWITCH
Footswitch functions can cover many areas, from selecting EQ and effects to, as in this case, allowing remote operation of the Mute function.



Rack system

Our rack system comprises a Peavey GPS 1500 power amplifier and a Line 6 Bass PODxt Pro preamplifier and modelling unit. Modelling preamplifiers contain digital technology that uses software programs to recreate the sounds of numerous bass amplifiers, speakers and effects. These programmes allow one to 'dial up' a bewildering variety of sounds at the touch of a button without your having to own any of the units. If you think of it as a multi-effects unit for amplifiers and cabinets, you'll get a good idea of what modelling preamplifiers can achieve.

Line 6 PODxt Pro

Front panel (overleaf)

1 SELECT
With 64 preset 'channel' combinations of amps, cabinets, and effects, turning the Select control allows fast access to either the factory presets or your own custom sound.

2 EDIT
Allows you to alter the factory preset sounds. With the Edit button pressed, the Select knob works as an editing tool, giving access to the parameters that can be changed to create your new sound.

3 SAVE
Once you have finished editing a sound, activating Save will store it for future use.

4 EFFECT ON/OFF BUTTONS
Used to turn any of the four effects on or off, or edit them.

5 CAB/A.I.R.
This button allows selection of your preferred cabinet, from 1 x 12" closed-back to 4 x 10" open-back. The *A.I.R.* option allows selection of a microphone type and location as if you were recording in a studio.

6 DISPLAY
Used to show every parameter or setting of the preamp.

7 SOFT BUTTONS
Used in conjunction with the display to set option.

8 EFFECT TWEAK
Adjusts the intensity of the selected effect unit.

9 AMP MODELS
Adjusting this control gives access to the various amplifier 'circuits' that are stored in the software programme. Usually classic amplifiers are used as the basis for amp models (see Bass Amplification, p78) and the Line 6 is no exception. Vox, Hiwatt, SWR, Eden Marshall, and Fender are just some of the models featured. The technology is also able to mimic the

number of controls found on the original amplifier and their characteristics.

10 EFFECTS
Effects modelling is achieved in the same way as amplifier modelling, with an emphasis on bass effects that are out of production and now seen as classics of their time. The Mu-Tron envelope filter, RAT distortion, MXR compressor, Boss CE-1 chorus, and A/DA flanger are just some of the pedals included, together with Line 6's own creations. These can be combined with any amplifier model.

11 DRIVE
Sets the level of the gain or distorted tone.

12 BASS/LO MID/HI MID/TREBLE
Unlike the shelving EQ of analogue amplifiers, which alters the levels of sound centred on fixed frequencies, the tone controls on the POD adjust the frequencies and levels at which they operate to match those of the amplifier model selected.

13 CHAN VOL
Allows you to set the relative volumes of your different amp/effect channels.

14 COMPRESS
A single control compressor, also based upon a classic model; in this case, the LA-2A studio compressor.

15 OUTPUT
Sets overall output level.

16 BASS IN
The input for the unit.

17 I/O & DIG SELECT
With so many options available, this control allows you to select input and output variables to match the rest of your working environment. You can programme the preamplifier for studio or playing live, and choose what effects loop you require and whether further equipment is connected to the unit. The POD then alters its connectivity options to suit.

Rear panel (right, top)

Unlike our simple Trace Elliot example, the rear panel of the PODxt Pro features numerous patching options.

1 ANALOG REAMPING INPUT/OUTPUT
Reamping is the studio process whereby an already recorded signal is re-recorded back into a second tone-altering device, often another amplifier, to give a warmer tone. In this case that second amplifier can be any of the amps modelled by the preamplifier. These recorded signals are usually balanced and at line level, hence the need for a second specific input. Unprocessed Bass Out lets you record a dry signal to a recording device whilst listening to the processed sound.

2 EFFECTS SEND / EFFECTS RETURN
As well as offering its own effects, additional external effects can be patched in here, either through the internal modelling system or direct (DI). The external effects must be line-level rack effects rather than pedals.

3 UNBAL ANALOG OUT
These unbalanced outputs normally deliver one signal with the preamplifier's models and effects (Model) and the other (DI) as a direct inject. They can be configured for recording or for an onstage amp. In bi-amp mode, however, lows are sent from the DI and highs from the Model output.

4 BALANCED ANALOG OUT
These outputs are intended for studio recorders and live mixing consoles. They are not affected by the front panel output control, so you can set your onstage amp volume without affecting the feed to the PA.

5 PEDAL
A variety of Line 6 floor controllers can be connected here, and the software will detect which controller is being employed.

6 USB
Allows connection to a computer with the option of downloading software to allow the unit to record onto popular recording software programs.

7 AES/EBU/S/PDIF
These inputs and outputs allow connection of digital signals.

8 MIDI
Lets you connect the PODxt to MIDI equipment so it can be remotely controlled and automated.

Peavey GPS 1500 Power Amplifier

Separate power amplifiers offer great flexibility in delivering a bass signal to a speaker system, with options for bi-amping, stereo, or mono 'bridged' outputs. If one were to opt for a bi-amp system, for example, shielded cables would need to be linked from the POD's Unbalanced Analog Out sockets (also marked Biamp Mode - Low High) into the High Z connections of channels A and B of the power amplifier, with unshielded speaker cable taking the signal from the Output section into a pair of speakers capable of handling the high and low ranges of the bass.

Front panel (left, bottom)

1 INPUT GAIN
Two input gains are used, one per channel.

2 DDT LEDS
Peavey's compression circuit provides protection against extreme peaks of signal that could potentially damage the speakers. These light up when compression is taking place.

3 EXHAUST PORTS
To prevent overheating of the circuitry, cooling air is drawn in by the twin fans at the rear and expelled via the front panel vents.

Rear panel (below, bottom)

4 INPUTS
The Speakon 'combo' connector ingeniously allows you to insert either quarter-inch or balanced XLR connectors, but occupies the space of one connector per channel.

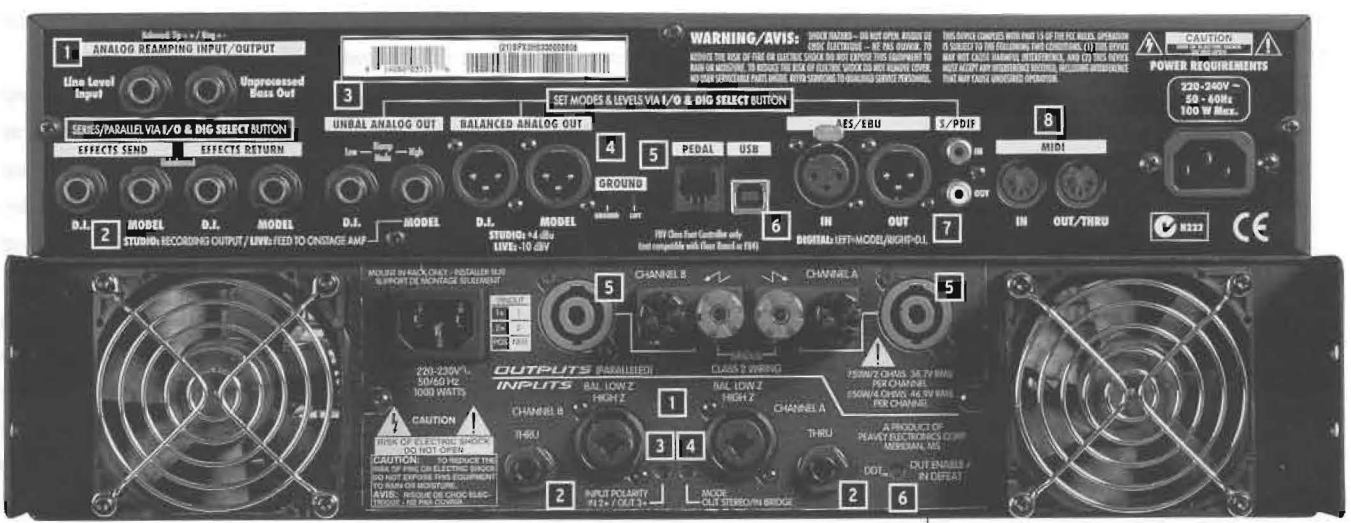
5 THRU
Allows further linking of the signal source to additional amplifiers.

6 INPUT POLARITY
This switch allows you to alter the polarity or phase of the XLR inputs. Peavey uses non-standard positive/negative input wiring compared with the international IEC standard, so you may need to adjust this to match other non-Peavey equipment.

4 MODE
In our hypothetical bi-amping scenario, this switch would be set to Stereo operation (switch out) although in effect we are using the amplifier as a dual mono amplifier, with highs being sent to channel A and lows to channel B.

5 OUTPUTS
Binding posts and Speakon connectors are offered to connect loudspeakers to the amplifier. Binding posts are used with banana plugs. Dedicated speaker cable must be used. The power output will depend on the final impedance of the speakers used. The inner terminals are the speaker signal outputs for each channel; the outer terminals are the returns. For mono operation, the mode switch must be set to Mono and only the two inner terminals of the binding posts used. Both amplifier channels will joined into the one output; hence the term 'bridging' the amplifier.

6 DDT
This switch turns on or off the amplifier's built-in compression circuitry. Since the DDT system is intended to protect speakers from the ill-effects of amplifier clipping, it is normall left in the on position.



The disadvantages of rack systems are higher cost, increased cabling (linking all those pieces together is normally done neatly and internally in a single amp head), increased power supply requirements (two or more mains cables are needed), weight, and transportability. Preamplifiers are often offered by manufacturers at the very high end of the market. The Aguilar DB680 is an audiophile-style preamp offering tube-driven (three 12AX7s and two 12AU7s) tone controls, fully parametric EQ, and a DI output powered by a Jensen transformer. It's a favourite with players such as John Patitucci and Gary Willis. Preamps with preset sounds are also common choices; rack specialist Rocktron offers a dedicated programmable bass preamp called the Blue Thunder.

Sometimes a simple preamp is all that is needed. The Tech 21 SansAmp RB-1 offers the much loved tone of the aforementioned Bass Driver in a rack-mount format. And Ampeg's SVP-Pro is essentially the front-end of its famous SVT range of all-in-one heads.

To ensure compatibility, a universal standard has been established for rack mounting. Standard width is 19" (483mm) and heights are referred to in multiples of 'U'. Thus a 1U rack unit is 1.75" (44mm) tall and a 2U rack is 3.5" (89mm) tall. Many preamps are a mere 1U in height. Power amps however tend to be a little bit bigger... and heavier.

The shock of the light weight of a preamp removed from its power stage is often replaced with a greater shock when picking up a dedicated power amp. Why, for example, is it heavier than most single unit amplifier heads? Dedicated power amps tend to offer very high output capabilities, using transformers and circuitry that can take long periods of use without detriment. Rarely are these beasts made as bass-specific models. Some of the best power amps are in fact destined for PA use. The objective is road ruggedness, a flat response and a wide frequency range. The idea is for the preamp to do all the sound shaping. The PA bias makes these power amps almost always stereo in operation. If your preamp has bi-amp controls then a high power bi-amp system is a reality. Adding further power amps can allow tri-amping, whereby the mid frequencies are sent to another set of amplifiers and cabinets. John Entwistle was a fan of tri-amping, and his rig became so vast he nicknamed it Little Manhattan. And it wasn't a new invention either as Entwistle explained: "I started developing that in about 1964! I always bi-amped, with the bottom driving two 4 x 12"s for bass sound and the top driving two 4 x 12"s for the top sound, each being driven by a separate amplifier. Tri-amping adds more punch to that."

Another option with rack systems is to split the signal into separate rigs covering dry sounds and sounds with effects added. This has the benefit of not muddying the fundamental bass tone whilst layering the more mid-frequency dependent effect sounds separately over the top. Bootsy Collins was one of the first to do this on a large scale, using a rig consisting of three independent amplifiers each driven from a separate output from his Space Bass, rather than through a crossover system. Chris Wolstenholme and John Paul Jones employ similar systems when playing basslines requiring effects, although interestingly neither relies exclusively on rack systems for this purpose.

Rack systems can be expanded with the addition of rack-mount tuners (with much larger displays than normal) such as the Korg DTR-1, or dedicated effects processors. The Line 6 Bass Pod rack mount unit is a 2U high preamp but contains hundreds of amplifier and cabinet simulations plus effects. Half width rack mount items can be mounted into 19" (483mm) rack units with the use of large rack ear adapters.

BASS LOUDSPEAKERS AND CABINETS

The factors that affect getting the right bass sound when selecting a bass cabinet include the cabinet design and the speaker design. Configurations today are more varied although the tried and tested formats of one 15" speaker and/or four 10" speakers in a well-designed cabinet still seem to be the favourite choices.

Speakers

For the average musician, loudspeakers are a confusing and little-understood area. Are bass and lead speakers really different? Are they interchangeable? What do I really need?

The history of loudspeakers goes back around a century. Early designs used cones made of thin tissue paper glued to a bamboo frame, and although these were very inefficient and prone to catching fire at only a few watts' input, the speakers found in bass amps today still work by the same principles. Virtually all speakers used in live music are moving coil designs. They work because when an electric current passes through a wire in a magnetic field, the wire will move (this is called 'the motor effect' because it is also the basis of electric motors). It also works in reverse: if a wire is moved in a magnetic field a current is produced, a principle used in dynamic microphones.

In a speaker, a coil of wire, the voice coil, is positioned in a circular magnet, and joined to a speaker cone to move the air. The amp supplies an alternating current to the speaker coil, which interacts with the magnetic field to make the coil (and therefore the cone) move in and out. This produces pressure waves in the air, which gives us our bass sound. The way these components are designed and specified controls the speaker's power handling, volume, and frequency range.

When amplified music started taking off, in the 1950s, the speakers used for the amps were essentially the hi-fi of the day; speakers were differentiated only by size and price. As musicians demanded bigger and louder amps, however, the speakers had to get tougher too; but for the most part lead, bass, and even PA systems were still using the same amplifiers and speakers. The bass amps of the day had little more bass than the lead amps, and in many cases were actually the same. Apart from higher temperature materials, the speakers changed little.

However, as amp technology developed, it became easier to deliver large amounts of low-frequency power. To reproduce deep bass, the cone needs to move a lot further than at mid or high frequencies, but the design of early speaker cones limited the amount of movement, and so the thin paper cones tore. The need for deeper bass and greater mechanical strength meant speakers had to change, and lead, bass, PA and hi-fi started to become specialised areas, each with its own techniques and designs.

To allow the cone to move further without damage, the paper outer edge of the cones was replaced by a ring of toughened cloth, formed into what can best be described as a bellows shape, and the cone was thickened and reinforced. This also helped to achieve a lower resonance (which increased output at the bottom end of the frequency range), and reduced distortion, giving a clearer, more detailed, and more natural sound. Cones with a thin paper edge are still used for lead guitar, as they don't have to handle deep bass, and are a major reason to not use lead cabinets for bass. You will tear the cones.

Bass guitar is one of the most demanding applications for a speaker. A wide (and balanced) frequency response is needed to go from clear natural bass on the open strings to the bite and attack of slapping or a pick technique. The dynamic range (the difference in signal level between the quiet and loud parts) is huge compared to that of recorded music (the peak of a 'slap' can easily be four times the level of fingerstyle playing), and the amount of volume required is pretty large. To cope with these needs many modern bass cones are reinforced with glass fibre, nylon or Kevlar fibres, or are made from aluminium in order to get a strong but lightweight and responsive cone. This is not cheap, and a bass cone often costs five times as much as a lead guitar cone.

Most manufacturers opt for the industry standard of a paper cone and ceramic magnet. Recently there has been a widespread use of neodymium. This is an ultra light material compared to standard magnets and cabinets sporting 'neo' drivers can weigh a fraction of a traditional cabinet. Not all makers are convinced of the sonic properties of neodymium but the performance/weight ratio is undeniable. Hughes and Kettner, Mark Bass, Gallien Krueger, and EBS are just some of the manufacturers offering neodymium equipped bass cabinets.

Hartke was a pioneer of the aluminium speaker cone. Its Transporter XL and Pro series cabinets all sport aluminium cones, which it is claimed provide fast response and detailed dynamics. Power handling tends to be slightly lower than paper equivalents (it now offers paper cones on its VX series cabinets) but they have found favour with bassists such as Jack Bruce and Tom Hamilton from Aerosmith.

The speaker components are assembled on a speaker frame. Frames are made of either pressed steel or the higher-spec cast frame made from die cast alloys. The rigidity of a cast frame design can aid performance in high-volume settings and also aids cooling as heat is drawn into the frame and away from the magnet.

Whatever your cabinet is loaded with there is always the option to upgrade. Companies such as Celestion, JBL, Electro Voice, and Eminence have made their names specialising in loudspeaker units. Although aftermarket single drivers can be more costly than the cabinet complete with drivers, they aim to offer the best in loudspeaker technology for the tone purist.

Cabinets

More than a mere box, especially if you want to get a decent tone, the bass cabinet incorporates the dual function of physically holding the speakers onto a solid surface and then dispersing the sound in an efficient way. Add to this the high internal pressures in the cabinet, the need for the cabinet to not colour the sound, and the design requirement for an acoustically tuned enclosure rather than just a wooden box, and the modern bass cabinet becomes an expensive (and heavy) item.

The speakers are attached to the baffle, a piece of wood with appropriate holes cut into it. The speakers can be front- or rear-loaded with access via a removable front grille or rear panel. The baffle can be made from MDF or, preferably, from plywood. Cost-saving measures mean many speakers are attached using screws; nuts and bolts are more durable and provide a better contact to the baffle, thus avoiding rattles.

The actual cabinet can be of a sealed, vented or horn-loaded design. Sealed cabinets are just that; fully sealed to keep the air contained within the cabinet when the speaker

is moving. This provides better damping (controlling the cone movement). More commonly, the cabinet is vented or ported. Vents (holes cut in the cabinet front or rear) or ducted ports (holes cut in the same places but backed up by lengths of material, often a round tube or square section of a set length) are used to 'tune' the cabinet to reinforce low frequencies. Transmission line cabinets, as used by Euphonic Audio, employ lengthy runs of internal porting to achieve a flat response rather than extended or boosted frequency ranges.

Horn-loaded cabinets are mysterious-looking devices. At first glance it seems as if there is no speaker in the cabinet, or it is facing backwards. Directing the speaker into the inside of the cabinet and then back into the audience is the basic principle of the horn-loaded bass cabinet. They are very efficient in reproducing extreme lows and were popular in the 1970s. Acoustic and Sunn both featured them in their amplification ranges.

Connections can be made by quarter-inch jack, XLR, or Speakon cable, although whatever is employed it must be dedicated speaker cable. Standard guitar cable will not suffice and could damage your amplifier.

Cabinet configurations

Loudspeakers can be combined into a cabinet in a variety of ways. The number of drivers, configuration and cabinet design will have a huge effect on the final sound. Fashion now seems to be dictating multiples of smaller drivers, whereas previously, bigger was considered better.

1 X 15"

In terms of numbers sold, this could well be the most popular speaker configuration ever. It is popular in combo formats and as a stand-alone cabinet. The single 15" driver tends to offer a bit of everything: good power handling, deep lows and, contrary to popular belief, a good dose of high-end as well. Mids are a little less growly and dynamics a shade muted compared to some other cabinets, but a lot of manufacturers make up this shortfall with a high-end tweeter or horn. It would be impossible to list every 1 x 15" cabinet as nearly every manufacturer offers one, although note should go to Marshall for having produced the monstrous 4 x 15" cabinet, a set-up favoured by Motorhead's Lemmy.

4 X 10"

A close runner-up to the 1 x 15" in popularity (and certainly surpassing it in recent times) the 4 x 10" cabinet is popular for dynamic techniques such as slapping, tapping and harmonics. Combined with a high-end tweeter, it is considered by many to be the perfect all-round cab. A well-ported design offers surprisingly deep lows (suitable for five-string extended-range basses), fast transient response, a smooth rounded tone that's great for pick playing, and high power handling. SWR's Goliath III and Trace Elliot's 4 x 10" 1048H are updates of their original designs, but like the 1 x 15", nearly every manufacturer offers a 4 x 10" cab in some format.

2 X 10"

A compact version of the 4 x 10", it is often used either as a stand-alone cab or as a

The Peavey Pro500 head amp and Pro210 2 x 10" cabinet. The compact cabinet also includes a horn tweeter for improved high frequency performance.

second cab to add on top of a 1 x 15" or 1 x 18". Well-ported designs such as the Eden 210XLT offer surprisingly good low-end response for a small cabinet, while others look to portability as their strength, such as Hartke's aluminium loaded 2x10XL. Epifani's T-310 3 x 10" cabinet neatly bridges the gap between a compact 2 x 10" and a full sounding 4 x 10".

1 X 18"

Once common but now considered quite a rarity, the 1 x 18" has been dropped by many manufacturers. A good design, however, offers trouser-shaking lows while sucking up huge amounts of amplifier power. Used with a 2 x 10" cab, it offers a rig with extreme frequency range. Look to the specialist speaker manufacturers for great examples of 18" cabs such as the SWR Big Ben.

4 X 8"

In the quest for more dynamic response some manufacturers have sought to use multiples of 8" drivers. Ampeg and Ashdown have offered 4 x 8" combinations and SWR went one step further with their Henry The 8x8 model with no fewer than eight 8" drivers and a high frequency horn.

8 X 10"

Still *the* rock and roll cabinet design, Ampeg's original 8 x 10" has made an icon out of a bass cabinet. Fat, smooth, and incredible with a pick, only its size counts against it. Eden, Peavey, and Ampeg itself now offer very high power handling versions of this classic design.

2 X 12"

The arrival of the 4 x 10" almost made the 12" driver redundant. But as music is fashion-driven, and currently all that's retro is 'in', the 12" driver is making a comeback. Although the 4 x 12" is still a rare beast, offered by Marshall and SWR in the UK and US respectively, the 2 x 12" has found favour and is especially loved by fretless players for its mid range growl and bottom-end response. Combined with a tweeter as in the Eden D212XLT or Bag End D12X-D it shouldn't be overlooked. As a portable option, the 1 x 12" plus horn is very popular at present, with models offered by Aguilar (GS112), Eden (CXM-112), Bergantino (HT112) and the ultra light EBS Neo112.

Mix and match

But why stick to the same drivers in one cabinet? Many combinations seek to offer the benefits of several types of driver in one cabinet. Perhaps the most popular option is the triad-style design with a low-end, mid, and high response unit in one cabinet. Although by no means the first company to mix differing drivers in one box, Trace Elliot started the ball rolling with an 18" and 10" driver in their 1818X cab. SWR's appropriately named Triad design offers a 15", a 10" and a horn in a four-ohm cabinet. Bergantino makes use of 15" and 6" drivers in its NV215 while Mesa Boogie opts to include every bassist's current favourite stack of a 1 x 15" and a tweeter-equipped 4 x 10" in one large cabinet called the PowerHouse 1000, the 1000 referring to its power handling. Remember, these

and any of the above options can be achieved through mixing a variety of cabinets, even from different manufacturers. After all, it's your sound you are after.

Why are guitarists so loud?

Anyone who has jammed, gigged or rehearsed with other musicians will have noticed that the lead guitarist seems to get away with a much smaller amp. There are three main reasons for this;

• **Frequency range**: bass amps cover the range from 40Hz (or lower) to over 10kHz (often 20kHz), while lead amps use a narrower band, usually from around 80Hz (an octave up) to not much above 5kHz. High frequency sound shifts less air and so requires much less energy input than bass frequencies. Bass sounds require more acoustic energy and hence more electrical power. A 100-watt lead amplifier, handling only mid-range and high frequencies, will therefore produce much more acoustic energy than a bass amp of similar power.

• **Subjective loudness**: the human ear is much more sensitive to mid-range than bass. For open E of a bass and a lead guitar to be equally 'loud', the bass would have to be 12dB louder. Also, the crunch and bite of lead guitar happen to coincide with greatest sensitivity of the ear and efficiency of the speaker. Indeed, for your open E to appear as loud as the top of a lead guitar would require an extra 35dB, which is equivalent to 3,162 times the power.

• **Loudspeaker efficiency**: the cloth edge and thick cone added to bass speakers for strength also adds weight. This makes speakers less efficient. As a result, they are typically 2 or 3dB quieter than lead speakers (for the same power input), and up to 10dB quieter in the ear's most sensitive region.

How much power do I need?

Volume and power are not necessarily directly connected. Volume depends on many factors including power, efficiency, and cabinet design. The decibel (dB) is used to measure sound pressure level, also known as volume or loudness. If the power of a system is doubled (say, 100 watts to 200 watts) the volume increases by 3dB. If it doubles again (200 watts to 400 watts), that's another 3dB. Whatever the relative powers, doubling always produces a 3dB increase. However, though you can hear a 3dB increase, to the ear it's not a big difference; to double the perceived volume takes around 10dB. This equates to a ten-fold increase in power, so to make your rig sound 'twice as loud' as it currently does, you need ten times your current power. But volume can be increased without upping the power levels. We can, for example, make the speakers or cabinet more efficient in delivering the power.

With the same speakers, a 200-watt amp will be louder than a 100-watt amp, but only by a maximum of 3dB. However, depending on its design, a 100-watt speaker (or cabinet) can be more or less loud than a 200-watt speaker. The power rating of a speaker is how much the speaker can take without burning out. It has no bearing on how loud the speaker is. For that you need the efficiency or sensitivity. This figure (expressed as

'dB/1w @ 1m') states how many dB will be produced by 1 watt of electrical input at a distance at 1 metre. Typically, bass speakers will have a sensitivity of between 95 and 100dB/1w @1m. A speaker with a sensitivity of 100dB will produce the same output level as a 97dB speaker driven with twice the power; ie, 200 watts into a 97dB speaker will be as loud as 100 watts into a 100dB speaker.

The frequency response, meaning the efficiency of the speaker at different frequencies, also has an effect. Generally speaking, a 10" driver will be more sensitive at mid-range and top frequencies than a 15" driver and so sound louder. There are no hard and fast rules with speaker performance, but a few guidelines are:

- Bigger diameter coils give more power handling, less compression, and more solid bass, but less bite and attack.
- Bigger magnets also give more power handling, 'tighter & faster' sound, greater efficiency but less warmth and bass.
- Bigger cones give more bass, but less top, and a slower, less responsive sound.

If you want a really bright, punchy sound go for smaller coils with big magnets. Look for high-sensitivity speakers. For warm and laid back, use big coils with smaller magnets. Aim lower in the sensitivity. As a general guide, a 4 x 10" cabinet will have a faster and brighter sound (due to lighter cones, and four magnets driving them) but a 1 x 15" will have clearer, warmer, and more natural bass. But it all depends on the speakers.

The power required depends on the user. There are several schools of thought. Some seek cabinets with power ratings that at least match, or exceed the power rating of the amplifier being used. Lead speakers are often run flat out so the cones distort and the coils get hot, giving a soft compression. However, this loses dynamics. Bass (especially percussive slap playing) needs dynamics, and having a speaker power rating significantly higher than the amp output will keep the coils cool, and the speakers responsive. Alternatively, players seek out amplification with extremely high headroom and use it to drive speakers of a lower rating, maintaining that delivering a clean, unclipped signal to the speakers is a better option than delivering a signal that is struggling constantly with the player's dynamics. This carries some risk of course; the user must be disciplined with volume, and tonal boost to prevent damage.

Further questions arise when considering the amplifier's impedance and the number of cabinets being used. More cabinets deliver more volume by moving more air and more often than not by lowering the impedance, which in turn unleashes extra power from the amplifier. A 200-watt head driving two 4 x 10" cabinets will normally sound louder than a 300-watt head driving one 4 x 10" cabinet, although the latter offers increased headroom.

The answer is to have as much power as you can possibly afford together with the greatest number and highest rating speaker cabinets you can afford.

Impedance and Ohm's law

It all sounds scarily like schoolroom physics, but impedance is important. Get this wrong and your amp could be damaged. Impedance can be viewed as the resistance load your speakers offer to the amplifier's outputted signal. As impedance is lowered, most

amplifiers can deliver more power. To discover the impedance of a single stand-alone cabinet, you simply read the specification on the back of the cabinet or consult your owner's manual. No label? Don't panic, you can use a multi-meter set to ohms and place it across the positive and negative (that's the tip and ring part) sections of a jack cable coming out from the socket on the back of the cab. For reasons best left alone now (we're already getting technical enough) this reading will be slightly lower than the most common impedances of 4 ohms, 8 ohms, and 16 ohms (readings of 3 ohms, 6 ohms, and 12 ohms are likely). Always make sure that the amp is happy with the cabinets you use, as most amps have a minimum load rating (usually stated on the rear panel: for example, 200W at 4 ohms minimum); if you let the amp 'see' less than this impedance, it could get damaged. What about a higher impedance cabinet? In this example, the use of a single 8-ohm cabinet would not produce the full 200 watts. The amplifier needs to see a 4-ohm cabinet to deliver its full power. But you can use it safely. Specifications vary amongst manufacturers (minimum loads are sometimes capped), but an 8-ohm cabinet would normally allow our 200-watt amplifier to deliver approximately 125 watts.

Combining cabinets creates its own set of rules, and this is where Ohm's Law comes in. You may be surprised to learn that using more than one cabinet in parallel (as they are when you plug them into the back of an amp) reduces the overall impedance rather than increasing it. You need to know how to calculate the new impedance.

When you are using two or more cabinets with identical impedances, two 8-ohm cabinets for example (although these can be dissimilar in terms of configuration, a 1 x 15" plus a 2 x 10"), things are straightforward. Take the impedance of one cabinet and divide by the number of cabinets. In this case, 8 ohms divided by two equals 4 ohms, which is our total load. Following the above example, our amplifier can now develop its full 200 watts (it 'sees' 4 ohms) and in addition it delivers its power into two cabinets, so that extra power pushes more air. Apart from the cost of the second cabinet it's a win-win situation. But things are more complicated with cabinets with different impedances (see Impedance, right).

BASS EFFECTS

History

Often seen as the preserve of guitar players rather than the low-end fraternity, effects have now become part of many a bassist's tonal library. The origins of many effects – for our purposes an effect is something that strives to move away from the original recording studio dream of a clean, pure sound – tended to come from accidents rather than intended use. Although legends such as Les Paul (of Gibson guitar fame) experimented with various tone-shifting devices at a very early stage, bassists at first were somewhat shy of moving away from the idea of undistorted sound. One happy accident is recalled in Art Thompson's book *The Stompbox*, when session player Grady Martin was required to lay down a solo for Marty Robbins' 1961 hit 'Don't Worry'. He used a Danalectro short-scale bass, and all went well until a channel in the mixing desk began distorting as the result of the failure of a valve. Running with the distorted tone, rather than fixing the 'problem' resulted in a take of what must surely be the world's first fuzz-bass solo.

IMPEDANCE

Working out the overall impedance of two 8-ohm or two 16-ohm cabinets is straightforward (see left). But if you have two cabinets of differing impedance, you have to use a different formula. Let's look at driving one 8-ohm cab and one 16-ohm cab.

The formula is $Z = \frac{Z1 \times Z2}{Z1 + Z2}$

Z = Overall impedance
Z1 = Impedance of cabinet 1
Z2 = Impedance of cabinet 2

So:

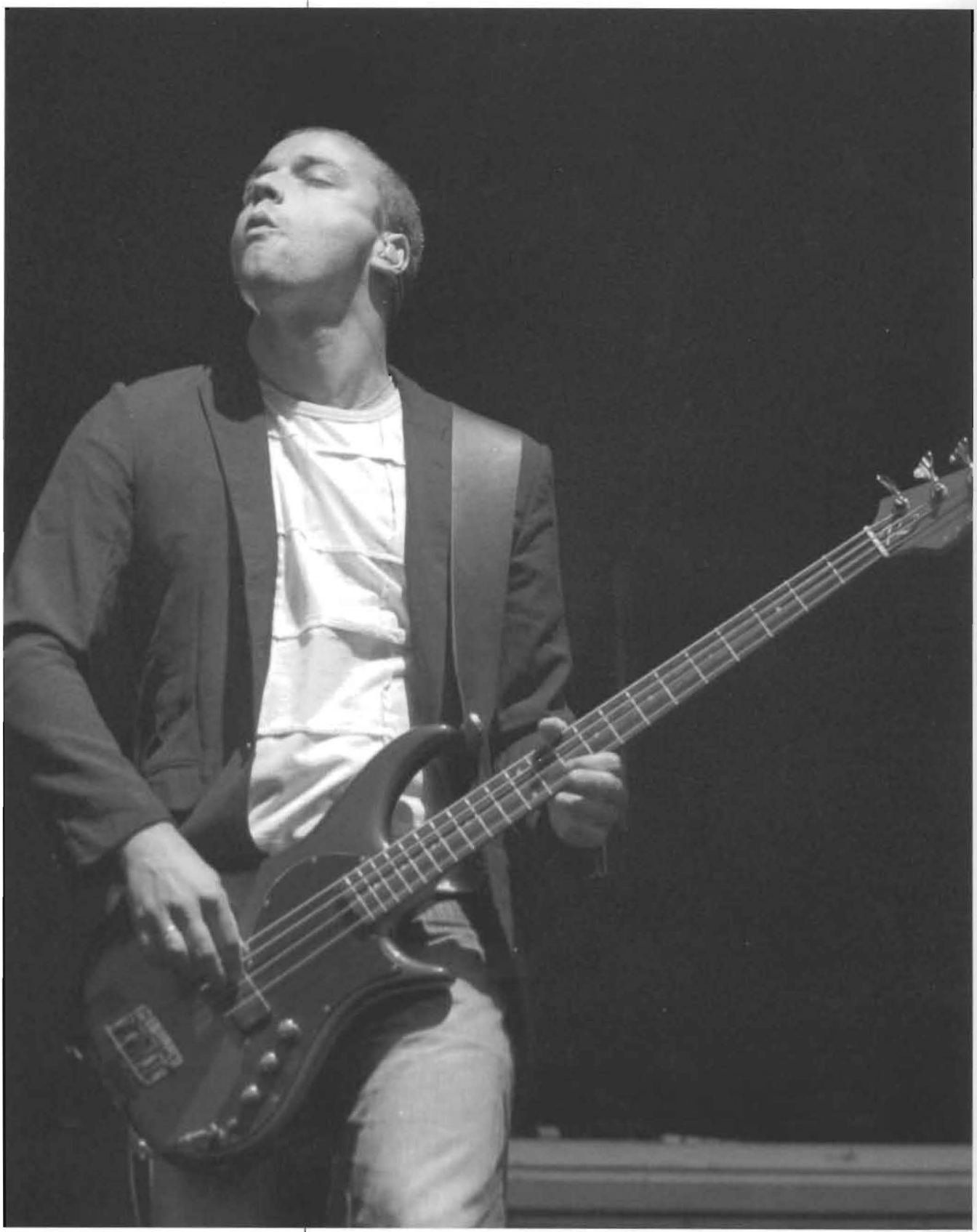
$$\frac{8 \times 16}{8 + 16} = 5.3 \text{ ohms}$$

As the amplifier's minimum load rating is 4 ohms, we can use this set-up; but be aware that the lower impedance cab will take more of the power than the higher impedance cabinet.
The formula for three or more cabinets, say a 4-ohm, an 8-ohm and a 16-ohm, is more complicated, and you will need your school algebra:

$\frac{1}{Z} = \frac{1}{Z1} + \frac{1}{Z2} + \frac{1}{Z3}\ldots$

Simplify $\frac{1}{4} + \frac{1}{8} + \frac{1}{16}$ and you get $\frac{7}{16}$, which is $\frac{1}{2}$. To find Z, you turn the fraction upside down, which gives you a total impedance of $\frac{16}{7}$ ohms = approx 2.3 ohms. That is too low for your amplifier's minimum load.

Understandably, you aren't likely to remember Ohm's Law in the heat of a gig, or when one of your drivers packs up and you need to borrow the support act's cab. There is a shortcut, so long as you remember that using two identical cabs halves the impedance rather than doubling it. So you can treat an 8-ohm cab as two 16-ohm cabs. A 4-ohm cab is equivalent to four 16-ohm cabs. Now use the rule for dealing with cabs of identical impedance: take the impedance of one cab (16 ohms) and divide by the number of cabs (seven). The result, once again is $\frac{16}{7}$ or 2.3 ohms. That's below our safe minimum of 4 ohms.



Legend has it that John Lennon came up with the term for another guitar processor, the flanger. As The Beatles pounded out their hits at Abbey Road, producer and 'fifth Beatle' George Martin was always looking for ways to facilitate his boys' sonic explorations. One of Martin's engineers, Ken Townsend, had discovered 'automatic double-tracking', using a second analogue tape machine to create a delayed version of the original vocal and then feeding it back into the mix. By varying the delay, a whooshing-type sound could be produced. Unsure how to explain this phenomenon to the non-technical Lennon, Martin offered the explanation that you "...take the original image and split it through a double vibrocated sploshing flange with double negative feedback..." And from that moment on Lennon would call for "Ken's flanger", until the advent of solid-state technology allowed companies such as A/DA and Electro-Harmonix to create the portable flanger pedal. Happy accidents indeed.

Types of effect

Effects are often grouped into different categories depending upon how they are electronically created.

Effects that alter the gain structure of an instrument are commonly referred to as dynamic effects. These would include variants of distortion, such as overdrive, fuzz and various boost devices. A further sub-category includes compressors and limiters.

Effects that rely on altering the time element of the original signal are often called time-based effects. Often these are subdivided into modulation effects and forms of reverb and delay. Modulation effects include the aforementioned flanger, phaser, tremolo, vibrato and chorus. Reverb and delay effects also include echo.

Filter-based effects manipulate a given set of frequencies either manually or by dynamic control and include wah-wah and envelope filters.

Dynamic effects

DISTORTION, FUZZ, AND OVERDRIVE Essentially these are three variations on a theme. One of the earliest ways of achieving an overdriven bass sound was simply to push an amplifier until it distorted. The earlier valve amplifiers certainly produced a sweet-sounding drive when used this way, as players such as Jack Bruce and Jack Casady of Jefferson Airplane proved by pushing their heads into distortion. An effects revolution was launched when the transistor allowed designers to recreate the overdrive effect at bedroom levels. Models such as the Electro-Harmonix Big Muff, now reissued in both US and Russian variations, were originally aimed at guitarists but worked well on bass. Chris Wolstenholme from Muse is one fan. In 1968, Larry Graham, bassist with Sly and the Family Stone, recorded one of the earliest deliberate fuzz-bass parts on the band's hit 'Dance To The Music'. He used a Maestro Fuzz-Tone. Paul McCartney is also credited on *Rubber Soul* as playing fuzz bass, using a distortion unit built by Abbey Road's finest engineers.

Most overdrive units contain three controls; gain, to alter the amount of distortion, tone,

Chris Wolstenholme of Muse often plays his Pedulla Rapture through an Electro-Harmonix Big Muff distortion pedal.

to alter the tonal characteristics of the sound, and output, to adjust the final volume. Some pedals, such as the Boss ODB-3, also have a balance or mix control to allow blending of the direct signal with the distorted signal.

COMPRESSORS AND LIMITERS A compressor controls the dynamics of your bass by limiting the signal peaks according to settings adjusted by the user. Extreme forms of compression are known as limiting. The effect is often misunderstood.

Most players can understand what a distortion pedal does, how echo is going to sound, and, maybe, what a chorus does. If anyone is in doubt, it's a fairly simple procedure to explain what each does by playing a few tunes where each pedal has been utilised. If you want to hear some nifty bass distortion, check out Flea's intro on 'Around The World'; for some haunting chorus, check out Chris Novoselic's bassline on Nirvana's classic 'Come As You Are', and for a bit of flanger try Hawkwind's 'Silver Machine'.

But what does a compressor do? Actually, it's quite simple in its most basic form. A compressor controls the dynamics of your bass guitar output. Imagine yourself playing a nice, smooth, fingerstyle bassline. If your technique is 100 per cent perfect (more of that later) then you will be playing at a certain volume level: let's call it level A. Now, imagine going into a hard aggressive slap-bass groove. You're popping and riffing for all it's worth. You could, for a moment, imagine you're Flea, who does adopt just such a playing style. This new playing aggression is going to produce a different volume level that we'll call level B. Level B is going to be much louder than level A, which can cause all sorts of problems.

If you were playing close to your amp rig's limits with the fingerstyle line, then all that slapping is just going to cause distortion (of the nasty sort). If you are in a studio environment, all the meters could end up going into the red, ruining a take. We could reduce the overall level so the slapping stays clean, but then we find all the subtleties of the fingerstyle line are lost because it's not loud enough.

The studio engineer could make sudden and drastic level changes with the mixer fader for these dynamic alterations, but wouldn't it be nice if there was a machine that did this for you? A compressor does just that.

No amount of compression can make up for uneven left and right hand techniques or poorly executed chops, but it can give a helping hand for when levels need smoothing out. FX manufacturer Guyatone points out how helpful the compressor can be: "Let's face it – no matter how great a player you are, it's virtually impossible to hit every single note at the same volume. Today's advanced playing techniques make it even more of a chore to maintain a solid bottom that doesn't drop in and out of the mix." Quite.

The compressor pedal is divided into two sections, the voltage controlled amplifier (VCA), which creates the volume control, and the detector (or side chain) that decides when the volume should be controlled. Controls are commonly as follows:

Threshold This sets the point at which the dynamics are controlled. When the input signal is below the threshold no change at all should take place. When the signal passes this point, the dynamics are altered according to how the remaining parameters are set. Blackbox, which builds the Oxygen compressor pedal, offers the following useful advice: "Too much limiting can cause the signal to sound dull and lifeless, because it kills signal

dynamics if overused." So go easy with that control, unless you are after a deliberate, heavily squashed sound.

Ratio This control decides how hard the volume should be compressed when it passes the threshold. It is measured as a ratio of altered signal to unaltered, hence the control's name. Signals below the threshold point have a ratio of 1:1; ie, there is no change between input and output. Put 4dB of signal in and you get 4dB out. If we turn the ratio up to, say, 2:1, then for every 4dB we put in over the threshold only 2dB is going to be allowed to reach your amp or mixer. With a 10:1 ratio setting (we're cranking it up now) for every 10db that goes in, only 1dB can leave. That's seriously compressing your signal.

Attack time This adjusts the time between the signal passing the threshold and gain reduction occurring. Do we 'attack' the signal quickly, or slowly?

Release time This adjusts the time between the input signal dropping below the threshold and the moment full gain is restored. If you hear undesirable 'pumping' or 'breathing' effects in the compressed signal, turn the release knob clockwise to a higher release-time setting.

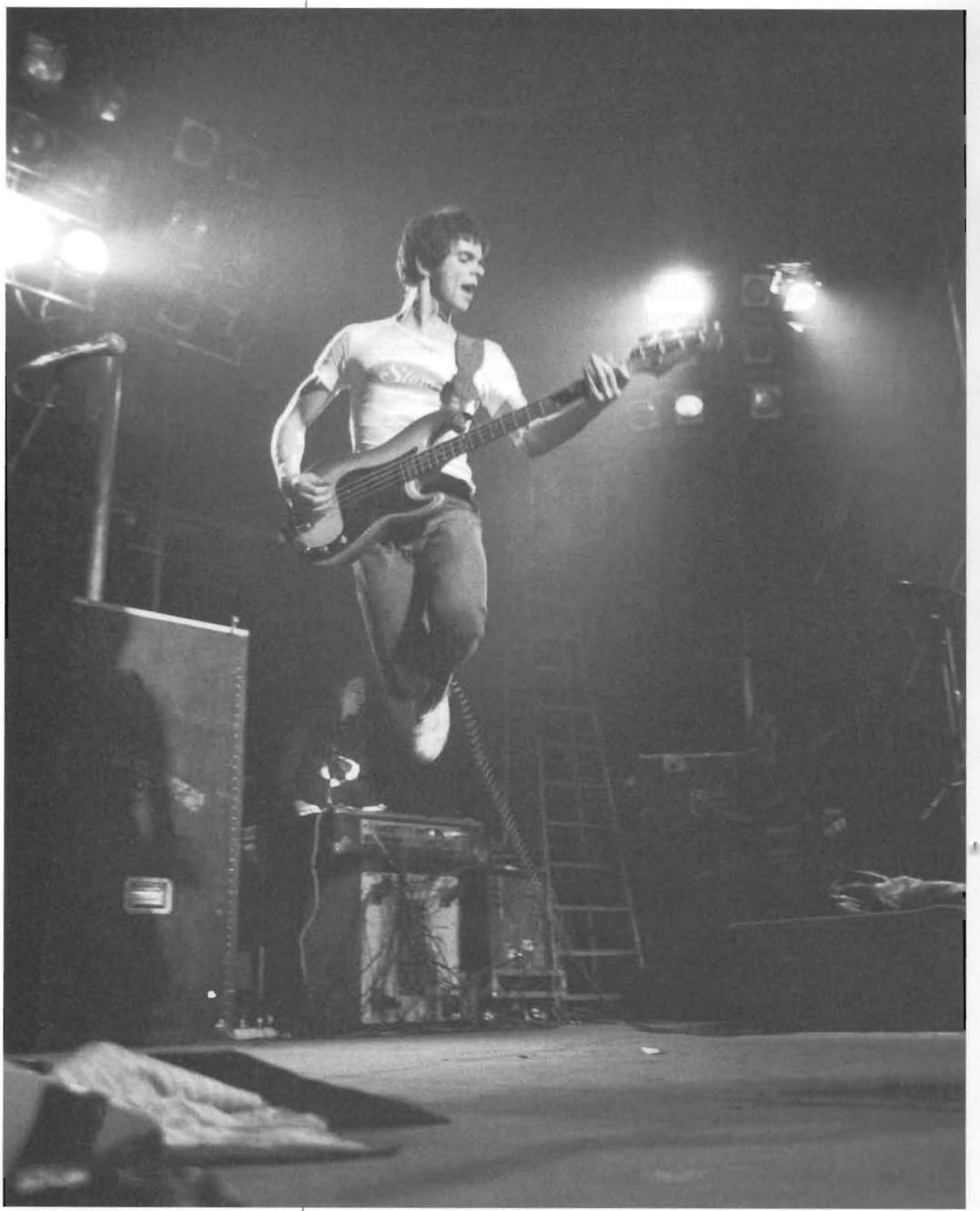
Compressors are often grouped with effects called limiters, which 'limit' a signal from passing a certain point. Often the limiter will have a very high ratio capability so that no signal passes at all. This would be useful for controlling, for example, any unwanted noise through a sound system to prevent its self-destruction. Compressors are loved by guitarists as well; their sustain and gain-enhancing capabilities are ideal for soloing. Compressors for bass tend to fall into two categories: those that want pure and clean dynamic control at any price, and those that favour a smooth tube-like distortion similar to that a vintage valve amp, which exhibits natural compression through its all-valve construction. The former is great for controlling the dynamics involved in slap-bass playing, whilst the latter is great for getting a grinding Billy Sheehan/Jack Bruce/Chris Wolstenholme tone.

The Guyatone compressor mentioned above also allows bassists to search out some growl along with dynamic limiting (or even in this case, boosting) capabilities: "Higher threshold settings yield a warm, round, slightly gritty tone similar to a hard-working tube amp. With low threshold and high level settings, the BL-2 can also be used as an uncompressed clean booster with up to 40dB of gain."

Modulation effects

CHORUS/FLANGER/PHASER/TREMOLO/REVERB/DELAY Modulation effects produce some of the most striking sounds when applied to bass guitar. Chorus offers up a lush, shimmering tone, as if two basses have been double tracked.

Boss has made a number of classic chorus units including a bass specific unit, the CEB-3. Nirvana's Chris Novoselic made the chorus pedal a must, after his bass part on Nevermind's 'Come As You Are', which used an Electro-Harmonix Small Clone unit. Chorus controls are often just two in number: rate to adjust the speed of the chorus shimmer and depth to adjust the intensity of the effect.



Flanging can create a whole host of chorus-like shimmers, swoops, and jet-across-the-sky whooshes. Ironically, its sound is perhaps so distinctive that many players have shied away from using it in recent times. Its strangely-labelled controls don't help matters, as it is a more complex beast than the simple chorus unit; manual sets the relatively short delay time, depth controls the sweep range, rate adjusts sweep speed and resonance (or feedback) sets the amount of feedback – not the howling type found when guitarists end their solos but the amount of signal regenerated back into the original signal.

During the 1970s, however, flanging ruled, and Mars Cowling, bassist with the Pat Travers band, was one of three members of the band using and promoting the A/DA Flanger foot pedal.

Defunct effects manufacturer Tychobrahe of California installed its flanger into a wah pedal allowing expressive control of the pedal. But these were made in limited number and are extremely rare.

Phasers offer similar modulation sounds to the flanger, though often with fewer and more obvious controls (the classic MXR Phase 90, for example, contains just one control, for speed). Phasers also seem to be out of fashion with bass players. Boss has seen fit to update its classic phaser design to accept inputs for both bass and guitar, while adding many new features.

Session ace Anthony Jackson did, however, record one of the most copied effects-filled riffs when he laid down the bass on 'For the Love of Money', a Gamble & Huff tune for The O'Jays. Utilising a Maestro Phase Shifter pedal, and sixteenth-note plectrum riffing, Jackson's intro is hailed as one of the great basslines of the 1970s.

Vibrato and tremolo effects are instantly recognisable for the pulsing sound they create and although rare for bass guitar have been used effectively by players such as Chris Squire ('Starship Trooper' from *The Yes Album*) and John Paul Jones ('Heartbreaker' from *Led Zeppelin II*). In the latter case, the bassist used a Leslie cabinet, an effect originally intended for organists, consisting of a speaker that rotated on a turntable inside an amp and cabinet. Today's solid-state and digital devices can now reproduce the same effect in a case smaller than a CD.

Reverb and delay are two time-based effects often grouped together because reverb is essentially an extremely short delay applied to the original signal. How short? Well, much reverb is still taken care of in guitar players' rigs via a 'spring' reverb, which turns the instrument's electrical signal back into vibrations, lets them excite the spring, and then turns them back into signal at the end. Blending the dry signal with the 'wet' (processed) signal creates a short delay to give the effect of playing in a large empty hall. Whilst guitarists can barely live without this effect, bassists tend not to enjoy the sound of playing in empty rooms, and usually prefer completely dry signals. Delay does, however, creep into a bassist's arsenal occasionally. Its distinct sound was perfect for the spaced-out sounds of Pink Floyd with Roger Waters employing it to great effect on 'One Of These Days' from *Meddle*. The Strangler's bassist, Jean Jacques Burnel, used delay on a simple bass solo in 'Strange Little Girl' and as an aggressive effect for 'Let Me Introduce You to the Family'. Echo, to all intents and purposes, is the same thing though some purists prefer the term echo for vintage or short slapback type delay.

Early delay units used analogue tape recorders with multiple heads to record and then repeatedly play back riffs, but like nearly all effects today, solid-state or digital devices

Jean Jacques Burnel made good use of delay effects with The Stranglers.

can reproduce these sounds and offer long delays in compact pedals. The Boss DD-3 is a long-standing and reliable favourite of many players and includes controls for effect level, feedback (controlling the number of repeats), delay time (to set the time between each repeat) and a mode button to group the delays from short slapback echoes to infinite hold, whereby the delay continues until the pedal is stopped. Jaco Pastorius used an MXR delay unit to sample his own riffs, repeat them and then solo over the top. In true Jaco style he would end the sample by jumping on the pedal, sometimes from the top of his Acoustic 360 amplifier rig! Dedicated sample units now offer these facilities with loop times of up to eight minutes, the ability to layer repeated riffs and sounds and the potential of storing the samples for later use. Digitech's Jam Man is perhaps the best known of these units. Some players have used such units to record entire albums and perform live shows, including Steve Lawson in the UK and Trip Walmsley in the US.

Filter effects

While some effects have found various degrees of popularity amongst bass players, the squelching, burping, organic sounds of envelope filters (also known as auto wahs and envelope followers) are almost essential tools in the arsenal of a funk bassist. Popularised by Bootsy Collins's work with Funkadelic, the envelope filter is a device that operates like a wah-wah pedal without the pedal part. To create the mechanical movement from pedal up to pedal down mode, the player's dynamics trigger the sweep through voltage-controlled filters. In other words, play softly for one response and, as Bootsy puts it, spank it a little harder and it gives off another response. This interplay is further intensified by the unit's controls; a peak control alters the filter's frequency, depth alters how hard or soft one hits the strings before the effect kicks in, while bandpass filters determine which range of frequencies are going to come into play. Taking the most famous envelope filter of all, the Musitronics Mu-Tron III as an example, further controls for drive allow the user to decide if the unit sweeps up from low to high or vice versa. Flea's use of the DOD FX25 Envelope Filter on his tuition video, *Adventures In Spontaneous Jamming And Techniques*, renewed interest in filter-type effects.

Other effects

Although not working on the same principles as a keyboard synthesizer, the Octaver is a popular pedal, often called a synth-based effect that normally drops the original signal down one or two octaves. Some pitch-shift pedals allow octaves to go upwards or even harmonise signals to other musical intervals, such as fifths and thirds. Digitech's Bass Whammy (and now Whammy II) incorporates a foot pedal, allowing on-the-fly instant pitch shifts. Simpler, compact pedal octavers include Boss's original OC-2 and now updated OC-3, the former used effectively in Pino Palladino's bass part in Paul Young's 'Tear Your Playhouse Down'. Controls commonly found on octavers include octave level, tone and direct level as found on the DOD FX35 Octoplus. These need careful tweaking to balance the clean sound against the dropped octave; and don't expect much action below the note C on the A string, as neither the tracking nor super low frequencies can be accurately reproduced.

Analogue synthesizer type effects have been around for many decades; the Electro Harmonic Bass Micro Synthesizer is one example. Digital technology, as found in the Boss

SYB-3, has allowed new pedals to replicate many actual synthesizer tones. Controls become a little more complex here. Many synth units include octave, sub-octave and direct/effect blend controls as per the standard octaver. In addition several filters are fine tuned by frequency, resonance and decay controls. If the price of these units puts you off, you can create some great synth sounds by combining an octaver with an auto wah.

The E-Bow doesn't look like most effects or operate like most effects, and doesn't sound like many either. A hand held device, it creates an electromagnetic current when switched on and is held by the player close to the strings of the bass. The magnetic field created allows the strings to vibrate and resonate, creating bowing sounds – hence the name. The E-Bow has an on/off switch and little else (although the latest Plus version has a harmonic setting for upper octave emphasis). The sound comes from your imagination. Bassist Michael Manring uses an E-Bow together with his fretless three-octave Zon Hyberbass to create stunning aural soundscapes.

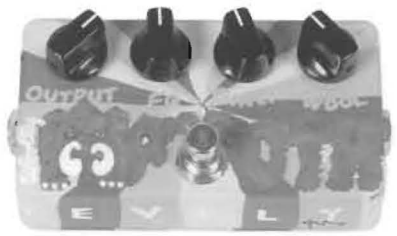
Combining effects

Bootsy Collins was one of the first bassists to start combining vast numbers of effect pedals to create new and exciting combinations. His pedal board consisted of the following; Mu-Tron III, Electro-Harmonix Big Muff fuzz, MXR Delay, Morley Fuzz/Wah, Morley Power Wah, Eventide Harmonizer, Mu-Tron Octave Divider, and Roland Space Echo. All were linked together via patch cables and kept in a large case that Bootsy called his Space Case.

With rack technology expanding during the 1980s it wasn't long before manufacturers decided to offer players multi-effects, consisting of a pedal board with footswitches and a circuit that offered numerous effects, all in one easy-to-use unit. The advantages of this set-up are that you only need one power supply to power all the effects and that numerous effects combinations can be recalled easily, using presets or patches. The Boss ME-6B was an early example of a multi-effects system dedicated to bass guitar. Its advantages are clear; it offered 11 effects, seven of which could be combined at any one time. Accessing these effect mixes was via six footswitches that accessed 25 preset sounds. Today, multi-effects for bass have broken new ground, with digital modelling of amplifiers and cabinets, effects of every type, built in drum machines and tuners, and in the case of the Digitech BNX model, a built-in 8-track hard disc recorder.

Such technology, however, still puts off lovers of all things analogue. Former Jamiroquai bassist Nick Fyffe still swears by a large pedal board of single pedals. His current rig includes no fewer than 14 pedals; SansAmp Bass Driver, Electro-Harmonix Q-Tron, Lovetone Meatball, DOD Graphic EQ, Q-Zone Dunlop Envelope Filter, Digitech Whammy II, Lovetone Big Cheese, EBS Octaver, Bass Dragger distortion, and several Boss Line Selector routing pedals. Doug Wimbish, performer of the famous Grandmaster Flash and Melle Mel's 'White Lines' bass riff, has also embraced the single pedal concept and made it a part of his sound, utilising Voodoo Lab Chorus, Vibrato, and Octave with SansAmp, TC Electronics, and Boss compact pedals.

Digital technology has also created the modelling type of effect whereby sampled sounds are recreated or newly created via software programs allowing the user to create



Three celebrated effects pedals: the Mutron III envelope filter (top), the Electro-Harmonix Bass Balls (centre), and the idiosyncratic Woolly Mammoth bass fuzz box (bottom), handmade by Zachary Vex.

tones simply by dialling in a preset sample. Line 6 has specialised in this field and its Line 6 Bass POD effects processor can recreate all types of effects, amplifiers, cabinets, studio microphones, and even specific circuitry from one compact unit.

And finally ...

UK session bassist Mo Foster, who has played with Jeff Beck and Phil Collins and appeared on hundreds of studio sessions, had a unique pedal built to assist him in difficult studio moments when producers were asking for a little something extra from the bassist. He called it the DFA Pedal, a simple box with an on/off switch. And yes, that's right, it did do absolutely nothing at all...

Signal chain location

US pedal maker Rocktron offers the following advice for compressing a bass guitar: "For bass it is recommended that you use a slower attack speed to avoid over-compression. We recommend placing our Big Crush [compressor] in your signal chain after the guitar or bass, but before any other processing. Thus, if you are using any other stomp boxes, put the Big Crush first, and then followed by your distortion pedal, delay and so on." Blackbox makes a similar observation, with one exception regarding pedals that work on varying dynamics to operate, such as the Mu-Tron III+ envelope filter made famous by bassists such as Bootsy Collins. "For optimal low noise operation, the compressor should go before any fuzz, distortions or anything which introduces a lot of noise into the signal chain. Because a compressor alters signal dynamics, any dynamic dependent effects (envelope filters, octavers, etc.) may need to go before the compressor. Make sure to use a high quality cable of the shortest length possible from your guitar or first effect in the signal chain to avoid picking up additional noise and degrading your instrument's tone." Ah yes, cables, we'll be looking at those later.

Like all good effects, a compressor may not sound its best if you use it on extreme settings, because it increases the noise floor along with the instrument signal. If your input signal already contains a lot of noise (even if you can't always hear it at low volume), this noise will be amplified by the compressor.

STARTING A PEDAL COLLECTION

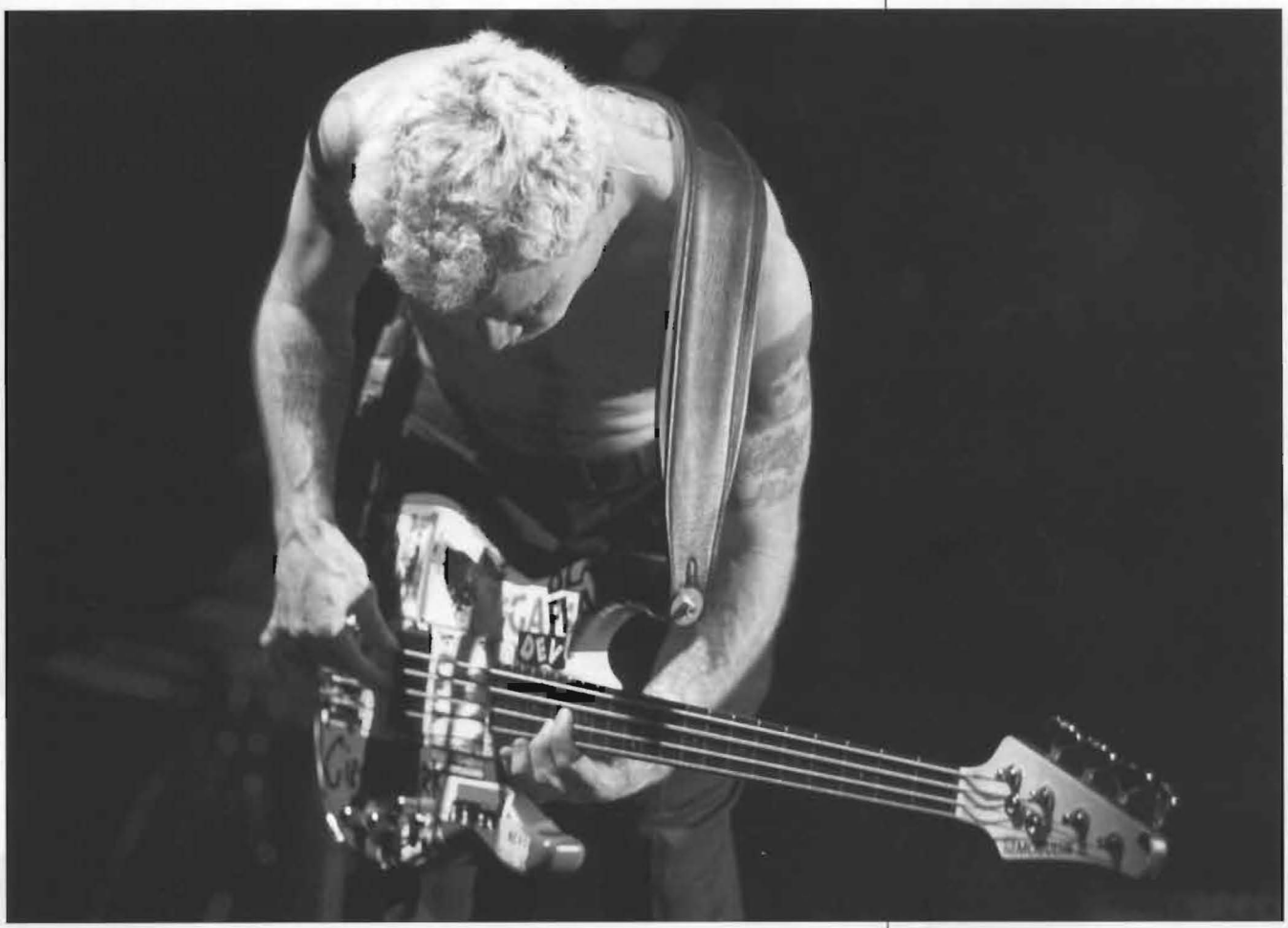
These are just some recommendations you may want to check out in your quest for an awesome pedal board.

- DOD Envelope Filter
- Boss DD-3 Digital Delay
- Morley Dual Bass Wah
- Electro-Harmonix Bass Balls
- Electro-Harmonix Big Muff
- Boss GE-7B 7-Band Graphic EQ
- Carl Martin Compressor/Limiter
- Line 6 Filter Modulator
- Digitech Jam Man
- Dunlop Brick Power Supply
- MXR Phase 90
- Ibanez FL9 Flanger

CABLES

How much?

You've saved for a lifetime for your dream bass. A cool £2,000/$3,500. And the rig is no less special. Developed over several years of fine tuning, you have the best combination of head and cabs for your playing style. So why did you only spend £15/$30 on the cables that connect it all together? Cables can have a profound effect on tone, something hi-fi purists have known for years, often allocating 10-15 per cent of system budget towards quality cabling. Cable quality and pricing varies enormously. From pennies to thousands of pounds or dollars. There is of course a sensible middle ground, and just as with hi-fi it makes sense to set aside a small budget for cables. For instrument purposes, I'd say 5-10 per cent is more realistic.



Flea of the Red Hot Chili Peppers uses a DOD envelope filter on his his favourite Modulus bass.

Cable types

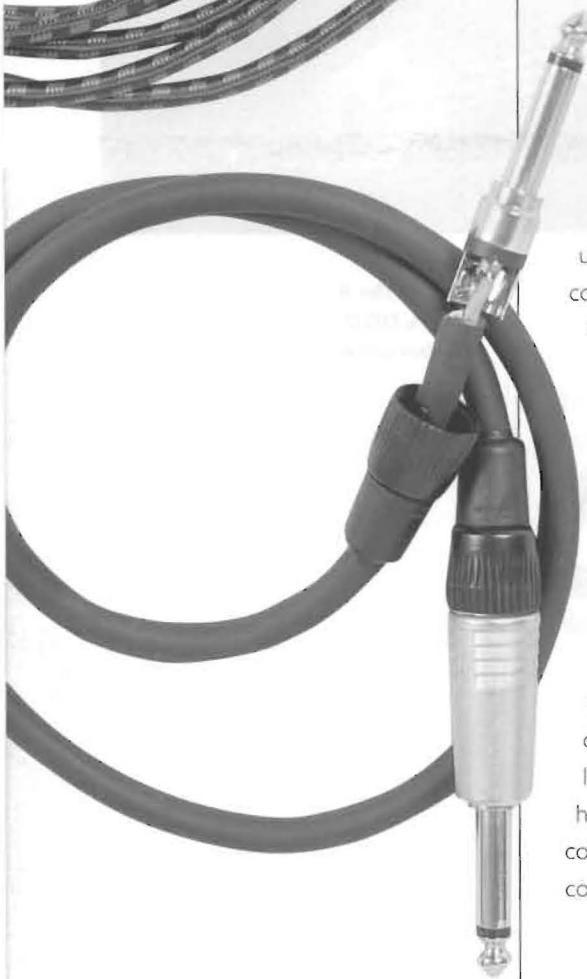
Essentially you will be dealing with two types of cable, instrument cable and speaker cable. They are different, but it is common to find incorrect usage.

Instrument cable uses shielding to protect signal from electrostatic and electromagnetic interference. An inner core conductor carries the signal whilst an outer shield aims to protect the conductor from external interference. Instrument cable also has to deal with the rigours of the road as it is coiled up, twisted, and stood upon by the drunken singer – repeatedly.

The best shield would be a solid wrap around the inner cable, preventing all outside interference from getting to it. Unfortunately such shielding has little flexibility and the resulting cable would soon break down.

More commonly, a wrapped or braided shield is used, the latter proving both flexible and good at noise resistance. Planet Waves, as one example, uses both an outer braid and an inner foil shield to protect against unwanted noise. Copper is the most common material. Handling noise (a crackling effect when moving the cable whilst plugged in) is also reduced by thorough cable design and the use of quality shielding and inner insulating materials.

Some companies make cable their total business. Monster Cable specifies conductors with bass specific frequencies in its Monster Bass cable, whilst M.I.T. cables use small micro



circuits (originally on boxes attached to the end of each jack connector- later inside the jack itself) to give increased cable performance, with its Hardwire XL promising extra bass response.

Alessandro holds the 'How Much?' record with its Instrument Pro model. A snip at $1,999.99/£1,200 for a 20-foot/6m cable. Some cable manufacturers also employ directional cable, where it is claimed signal flow is better in one direction than another. A hard one to justify audibly, and don't worry, there are no ill-effects should you connect the cable the wrong way round.

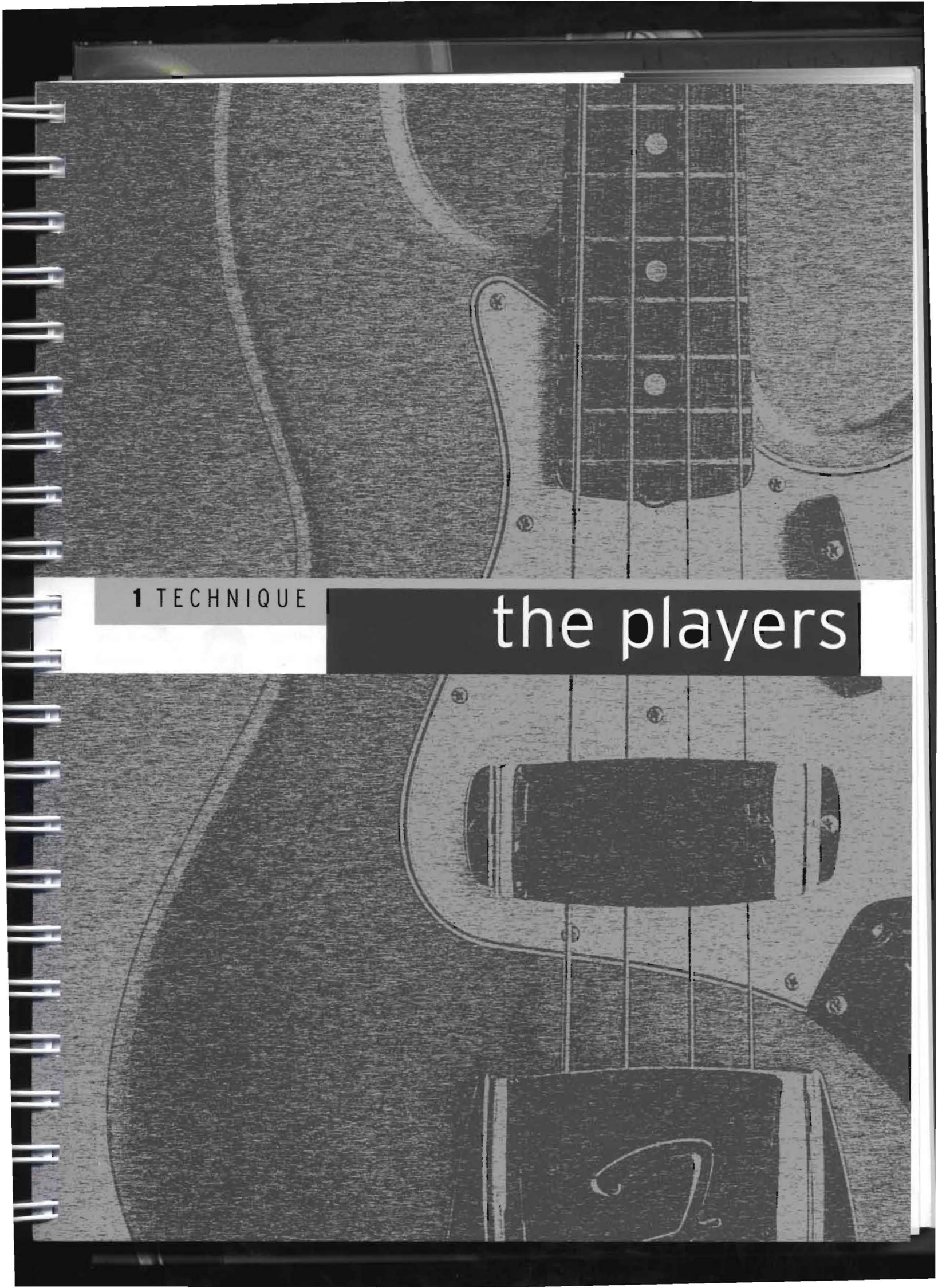
One way to improve tone is to avoid high-end loss caused by capacitance. Essentially, the longer the cable used the more its capacitance increases, which reduces high frequencies. Shorter cable runs can help restore that tone as effectively as quality cables.

Speaker cable performs a different role. It needs to carry large currents and not have an impact on impedance. Consequently it is often of much heavier gauge wire (the lower the number, the thicker the cable) and uses no shielding. A shielded cable would have an effect on overall impedance and so its use in a speaker system is a definite no-no. At best you will reduce performance, at worst (especially on a valve amp) you can cause transformer failure. Using a speaker cable on an instrument, on the other hand, will let in lots of interference. Not good, but instantly recognisable and easily remedied.

Connections

Instruments use the standard quarter-inch jack (phone plug) almost universally. Occasionally a manufacturer will employ a balanced XLR connector output together with the necessary circuit to run such an output; Wal is a good example. Planet Waves uses a neat trick of adding compression springs to the jack sleeve of its quarter-inch connectors, while gold plating them for long corrosion-free life. Evidence Audio is just one of hundreds of cable specialists that employs high-quality connectors made by the world-famous Neutrik company. Some musicians confuse Neutrik and XLR connectors, but Neutrik make many types of connector. I like the simple but effective way Evidence Audio employs different colour jack-plug shells at each end of the cable. The cable's jacket is a tough but slightly less flexible cloth-type material. Switchcraft is another respected manufacturer of quality connectors.

Speaker inputs can be of quarter-inch, XLR, Speakon, or binding post design. The former is cheapest and simplest in construction, but does give a slightly less than perfect fit and can easily be accidentally pulled out. It is also not considered suitable for high power applications. Trace Elliot employed XLR speaker connectors on many of its early designs for a more positive connection. Binding posts require a cable connection with banana plug ends. These are capable of carrying much higher loads and are seen on much pro spec equipment. The Speakon allows high power handling and offers a neat locking system in which a slot must be aligned and the connector rotated to make a good contact. Remember though, no matter what the connection, the correct speaker type cable must be employed here.



1 TECHNIQUE

the players

The Fender Precision bass guitar was introduced in 1951, but it took a while for anyone of any note to play the instrument. Lionel Hampton's jazz-R&B band adopted one in 1952, first with Roy Johnson playing it and then William 'Monk' Montgomery, but this was the exception rather than the rule. In the early days of rock'n'roll a bass guitarist was still hard to find, and the bassists behind artists such as Bill Haley, Elvis Presley, and Buddy Holly played upright bass. But by the late 1950s there was an increasing need for an amplified electric instrument to go along with electric guitars and a louder, brasher style of rock'n'roll. The sound was something quite new...

Where the electric bass guitar really came into its own was with the instrumental guitar bands of the late 1950s and early 1960s. It proved to be the perfect complement to the emerging line-up with lead and rhythm guitarists. Nokie Edwards of The Ventures and Jet Harris of The Shadows were the first really prominent bass guitarists in the post-

Nokie Edwards (right of picture) with The Ventures.

rock'n'roll era; listen to 'Walk Don't Run' (1959) by The Ventures and 'Apache' (1960) by The Shadows for great examples of their style. However, even by the early 1960s the bass-rhythm-lead format was by no means firmly established, as was made clear by the words of the doomed A&R executive who turned down The Beatles in 1962 with the infamous statement: "Guitar bands are on the way out." In fact it was just the beginning, and The Beatles, more than any other group, created the template for the modern rock band.

The Beatles' bassist, Paul McCartney, is a hugely gifted multi-instrumentalist. His playing on the early Beatles records was simple and effective, but it gradually became more prominent, notably in 1966 with the single 'Paperback Writer', its b-side 'Rain', and the album *Revolver*. With these landmark releases he started to play more fluid and inventive basslines, with a heavier sound achieved by close-miking of the speaker. McCartney continued to develop a highly melodic approach to bass playing on 1967's *Sgt Pepper's Lonely Hearts Club Band* and then *The Beatles* (1968) (often known as 'The White Album') and *Abbey Road* (1969).

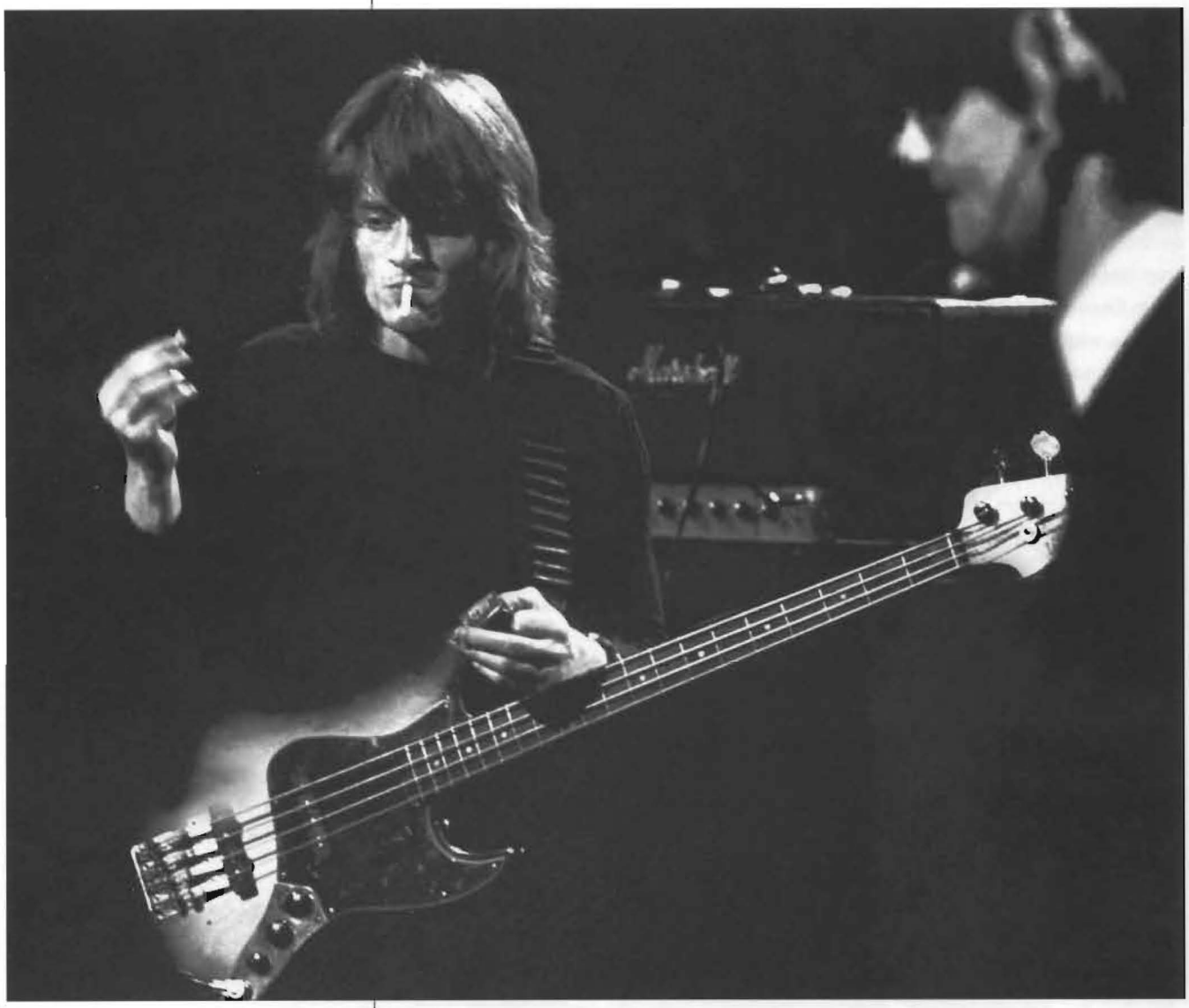
Of The Beatles' contemporaries during the so-called British Invasion, the most significant bass players belonged to two of the most prominent bands: The Rolling Stones and The Who. Bill Wyman's playing with The Stones was deceptively simple; check the basslines to '(I Can't Get No) Satisfaction' (1965) and 'Jumpin' Jack Flash' (1968) for examples of his ability to create the right counterpoint to the band's R&B arrangements.

Unprecedentedly loud

John Entwistle's bass playing for The Who was at the other end of the scale, self-consciously virtuosic and constantly battling for prominence with the drums and guitar. Using revolutionary new roundwound strings, which he helped to develop with Rotosound, and unprecedentedly loud amplification, Entwistle's bass cut through the enormous sound created by his group. Their third single, 1965's 'My Generation', was a showcase for his astonishing chops, and was the first pop song to feature a bass guitar solo. *Tommy* (1969), the extraordinarily powerful concert album *Live At Leeds* (1970), and *Who's Next* (1971) provide wonderful examples of his muscular technique.

Meanwhile, back in America, The Beach Boys were building ever more advanced pop-rock arrangements, and the bass guitar played a crucial role in the sophisticated orchestrations of the band's writer and arranger Brian Wilson. He was the original bass player for the band, but he increasingly used session players such as Carol Kaye to perform the parts he'd concocted. The basslines throughout the 1966 Beach Boys album *Pet Sounds* and its follow-up single 'Good Vibrations' are fantastic examples of the unorthodox role that the bass plays in Wilson's best work, weaving complex counterpoints across the entire tonal range of the bass.

In 1967 the psychedelic rock movement took flight, bringing adventurous new sounds, textures, and structures into rock music. Leading the way were the San Francisco acid-rock band Jefferson Airplane. Bassist Jack Casady boasted an advanced plectrum technique, which he applied to his highly developed melodic lines and chords, absorbing aspects of lead guitar into his bass playing. The band's album *Surrealistic Pillow* (1967) is the cornerstone of the psychedelic movement and a great place to hear Casady's style in action. Another band from the same city who played a major part in the hippy movement were The Grateful Dead, and their lengthy stage jams were legendary among



John Paul Jones of Led Zeppelin on a Fender Jazz Bass.

the Dead's legion of fans. Phil Lesh's fluid and inventive bass work was highly exploratory, and the *Live/Dead* album (1970) is the definitive document of his improvisatory musical approach.

Further sonic developments were taking place in the UK's underground clubs via the inspired sounds and arrangement-driven music of Pink Floyd, with composer and bassist Roger Waters adding both sparse and catchy melodic basslines, usually on an echo-laden Fender Precision Bass. The 7/4 groove of 'Money' from the band's ground-breaking *Dark Side Of The Moon* album, (1972) is rightly hailed as one of the most memorable classic bass riffs ever recorded.

While these musicians were turning the sound of rock and pop bass on its head, a parallel revolution was taking place in black American soul music. The supreme exponent here was one James Jamerson, the house bassist for the hugely popular Motown label in Detroit during the 1960s and early 1970s. Jamerson's playing style was informed by his

jazz background, and his fluent eighth-note lines, syncopated grooves and chromatic passing notes established him as the pre-eminent funk and soul player of his era. His list of credits takes in most of the enormous Motown hits of the time, and you can hear him at his best on the singles 'Bernadette' by The Four Tops and 'I Was Made To Love Her' by Stevie Wonder (both 1967), as well as Marvin Gaye's 'What's Going On' (1971). Another great soul bass player of this era was Donald 'Duck' Dunn, the bassist for the Stax and Volt labels, and his solid groove is at the foundation of such legendary singles as 'In The Midnight Hour' by Wilson Pickett (1965), Sam And Dave's 'Soul Man' (1967), and Otis Redding's posthumous hit 'Sitting On The Dock Of The Bay' (1968).

As the 1960s progressed, musical styles developed quickly. In 1966 the supergroup trio Cream launched their brand of psychedelic-tinged blues-rock and became famous for raising the bar in terms of musical proficiency. Jack Bruce played bass and took the lion's share of vocal duties, and you can hear some of his best work on *Disraeli Gears*, the band's landmark album from 1967. Led Zeppelin were another powerful British blues-rock band, formed by session guitarist Jimmy Page in 1968. Bassist John Paul Jones had been a session player, like Page, and his fluent blues lines and deft touch made a massive contribution to the band's sound. Some of his best work can be found on the group's second album, *Led Zeppelin II* (1969).

The early 1970s saw music covering new ground under the banner of 'progressive' rock. One of the biggest bands in this movement were Yes, a group of highly accomplished musicians heavily influenced by classical music. Bassist Chris Squire had a thundering sound and a superb plectrum technique, which can be heard to great effect on *Fragile* (1971). Rush were another progressive rock act that favoured concept albums and long classical-length rock suites, and their bassist Geddy Lee combined a ferocious attack within a powerful techno-rock setting. Rush managed to develop their sound into the 1980s, with *Permanent Waves* (1980) and *Moving Pictures* (1981) brilliantly showcasing Lee's style.

Devastating grooves

Also during the 1970s, 'fusion' developed, a potent blend of jazz and rock first instigated by the perennial musical catalyst, Miles Davis. Chick Corea's band Return To Forever featured the talents of bass virtuoso Stanley Clarke, who went on to great individual success with his solo albums *Stanley Clarke* (1974) and *School Days* (1976). His lightning-fast slapping and fingerstyle techniques provided some devastating bass grooves and solos, and his unique piccolo bass guitar extended the range and expressive power of the instrument into new areas.

Arguably the most influential bass player of the 1970s was Jaco Pastorius, who launched himself in 1976 with his self-titled debut solo album. His unique style had already developed to its full maturity on this landmark recording – machine-gun 16th-note funk grooves, chords, harmonics and, perhaps most astonishing of all, a fully formed fretless bass style the like of which had never been heard before. His work with fusion band Weather Report is best represented by the phenomenally successful 1976 album *Heavy Weather*, but it's also well worth checking out his playing as a sideman with Joni Mitchell on her *Hejira* album of the same year, which demonstrates a more sensitive and melodic side to Pastorius's fretless playing.

Funk bass also took huge strides during the 1970s, and Rocco Prestia's work with Tower Of Power is still admired by funk bass players today. For a pure funky groove he can't be beat; *Bump City* (1971) and *Tower Of Power* (1973) provide textbook examples of how to construct an effective funk groove. Even more influential was Larry Graham, bassist with Sly & The Family Stone, who invented the percussive 'thumb slap' technique. This became arguably the most influential new approach to the bass guitar in its history, and a whole generation of funk, soul and even rock bass players soon adopted their own version of slapping during the decade and into the 1980s. You can hear Graham's pioneering use of this technique on the 1971 Sly album *There's A Riot Going On* and during his later work with his own Graham Central Station band.

Anthony Jackson is a player whose session work for a number of soul, funk and rock bands during the 1970s and beyond has received much attention from bass players around the world due to his excellent feel for a groove and consummate technique with both fingers and plectrum. Jackson established his reputation with some crucial sessions for the legendary Philadelphia soul producers Gamble & Huff in the early 1970s. His bassline on 'For The Love Of Money' by The O'Jays (1974) is a classic example of his willingness to experiment, with its phased sound and percussive plectrum attack. Jackson's long list of credits includes work with Quincy Jones on *Sounds... And Stuff Like That!!* (1978), Chaka Khan on *What Cha Gonna Do For Me* (1981), and Paul Simon on *Hearts And Bones* (1983).

Another player hot on the funk scene was Bootsy Collins. As a mere 18-year-old he had established his credentials as part of James Brown's backing band in the late 1960s. He went on to work with George Clinton's Parliament/Funkadelic outfit of the 1970s – listen to Parliament's *Mothership Connection* (1976) for Bootsy at his best – and he also formed Bootsy's Rubber Band, whose first album, *Stretchin' Out In Bootsy's Rubber Band* (also 1976), brilliantly demonstrates his style.

The team behind Chic were the leading creative exponents of disco, the pre-eminent dance-music style during the late 1970s. Bassist Bernard Edwards had a punchy tone and a bubbling fingerstyle technique, and his work with guitarist Nile Rodgers was the most sophisticated and danceable disco music around. Edwards's bass parts on the 1979 hits 'I Want Your Love', 'Good Times', and 'We Are Family' (the first two with Chic; the latter with Sister Sledge) are beautifully constructed and instantly recognisable.

Another major revolution in the late 1970s came with punk and new wave. Although generally eschewing musicianship in favour of passion and attitude, some players stood out for their daring new approach to their instruments, unhampered by the pressure of doing things 'the right way'. Bruce Foxton of The Jam created basslines for singles such as 'Down In The Tube Station At Midnight' (1978) and 'Start!' (1980) that mixed punk's dynamism with a concise 1960s-style approach, and he was a crucial part of the band's sound. Jean Jacques Burnel of The Stranglers produced an aggressive, buzz-saw tone that was heavily to the forefront of the mix and central to the arrangement on the 1977 singles '(Get A) Grip (On Yourself)' and 'Peaches'.

Maintaining the hard-core emotions of punk but placing more emphasis on technique, thrash metal is a genre that has also produced some excellent bass players, perhaps none more so than Metallica's Cliff Burton. Favouring a classically influenced lead style of bass playing, Burton agreed to join the black-clad metallers on the basis that he

Session great Anthony Jackson on his six-string Fodera bass.

could keep his live solo bass slot. Messrs Ulrich, Hetfield and Hammett agreed and the results – *Kill'Em All* (1983), *Ride the Lightning* (1984) and *Master of Puppets* (1986) – showcased the bassist's talent. 'Anesthesia (Pulling Teeth)' is regarded as a solo bass masterpiece with its arpeggios, wah and distortion-soaked lines.

Post-punk, a new wave of independent and alternative bands emerged with a dizzying array of fresh ideas. The Police's brand of new-wave, pop, and reggae was driven by Sting's bass playing and singing – his bass part for the 1979 single 'Walking On The Moon' is a perfect example of a melodic bassline that exists at the very heart of the song. Peter Hook of Joy Division, and later New Order, often created bass parts as complementary melodic lines. Listen to the 1980 singles 'Love Will Tear Us Apart' and 'Atmosphere' by Joy Division for good examples of his approach.

Almost supernatural

Back in the world of rock, Billy Sheehan caused a major sensation with his incredible mastery of advanced techniques. His revolutionary style has been likened to that of guitarist Eddie Van Halen, and he first made a major impression on ex-Van Halen singer David Lee Roth's debut solo album from 1989, *Eat 'Em And Smile*. Check out his almost supernatural doubling of guitarist Steve Vai's left-hand tapping lines on 'Shyboy' and his awesome solo on 'Elephant Gun'. He continued to push the limits of heavy rock bass with Mr Big and on his own solo albums.

The late 1980s and early 1990s saw alternative rock and indie music broaden its appeal to a vast new audience, and brought forward a new generation of bass heroes. In the UK, a new so-called 'baggy' sound came out of Manchester, led by The Stone Roses, whose bassist Gary 'Mani' Mounfield provided the groove. Listen to their classic 1989 debut album *The Stone Roses* for an insight into his memorable bass hooks and loping rhythms. The Red Hot Chili Peppers bassist Flea is an awesome player whose attack and bravado has created a host of imitators. His blend of funk, rock and punk styles can be best heard on *Blood Sugar Sex Magik* (1991) and *Californication* (1999). Les Claypool, bass player and singer with the alternative band Primus, takes a maverick approach to the bass. *Sailing The Seas Of Cheese* (1991) provides a great example of his unique blend of slapping, tapping and strumming techniques, much of it on a six-string fretless bass.

In the wake of the pioneering jazz-rock fusion work of Jaco Pastorius and Stanley Clarke there followed other influential players who continued to develop the art of bass playing. Marcus Miller has an impressive slap-bass technique and is a master of the groove. His work with Miles Davis on *Tutu* (1986) and *Amandla* (1989) cemented his reputation as a supremely talented bass player and gifted musical arranger. Victor Bailey took over from Jaco Pastorius in Weather Report and played some mean bass grooves on a string of excellent albums, including *Domino Theory* (1984) and *This Is This* (1985). John Patitucci has an astonishing six-string bass technique, and his fast and fluid fingerstyle playing on *The Chick Corea Elektric Band* album (1986) was an eye-opener for many modern bass players.

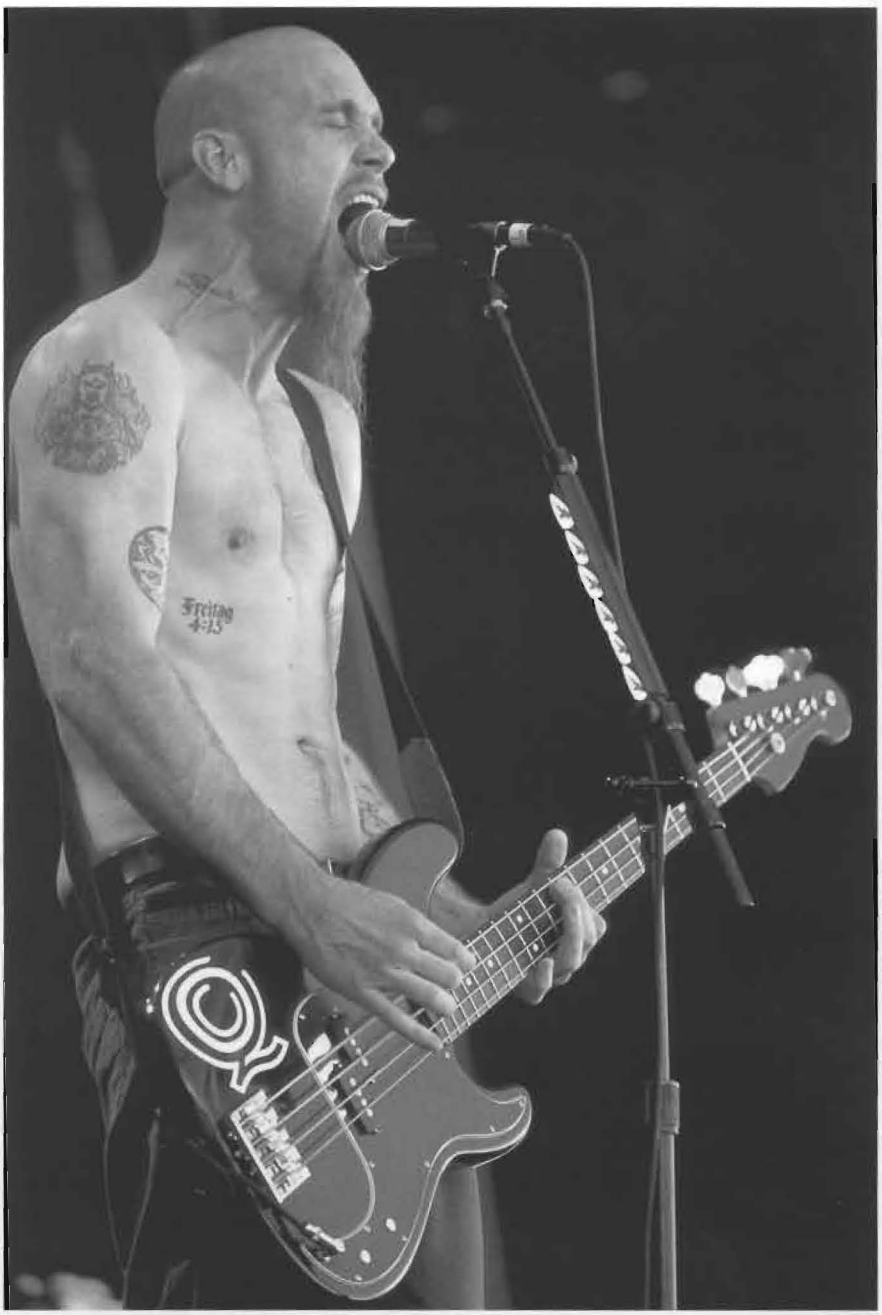
In the UK, Mark King fronted the British pop-soul band Level 42 as vocalist and bassist in the 1980s. His super-fast slap technique on *Level 42* (1981) won him many admirers and influenced a whole new generation of funk and soul players. Pino Palladino took the Jaco fretless-bass approach into a pop-soul setting on Paul Young's *No Parlez* (1983) and

more recently demonstrated another side of his musical personality with his laidback contributions to D'Angelo's *Voodoo* (2000).

The legacy of great bass playing continues today, with a fresh generation of players taking the instrument into new areas. Me'Shell NdegéOcello (below) is a hugely talented musician who lays down an awesome bass groove. Her debut album *Plantation Lullabies* (1993) was a superb amalgamation of traditional funk and soul combined with a more contemporary hip-hop sensibility. One of the most high-profile virtuoso bassists around today is Victor Wooten, who's gained a huge reputation among bass players due to his mastery of advanced techniques such as slapping and two-handed tapping. His work with Béla Fleck & The Flecktones showcases him at his best, and their self-titled 1990 debut album is a great place to hear Wooten. Nick Oliveri has become an icon to rock bassists in the opening years of the 21st century, providing stoner rockers Queens Of The Stone Age with a kick-ass hard-pumping bass foundation on *Rated R* (2000) and *Songs For The Deaf* (2002). Punk-ska band Rancid have Matt Freeman on hand to drive their songs with a pneumatic-power-drill of a sound; his inventive, lead-like lines are excellently showcased on *Indestructible* (2003).

And the future? James Leach is playing highly evolved techniques on his five-string bass with Sikth, a group of astonishingly accomplished musicians who mix extreme metal, jazz, punk, and even poetry. Their music is a melting pot of styles delivered with a blazing virtuosity and includes remarkably fast runs and unison two-handed tapping riffs. Check out the band's 2003 debut album *The Trees Are Dead And Dried Out – Wait For Something*

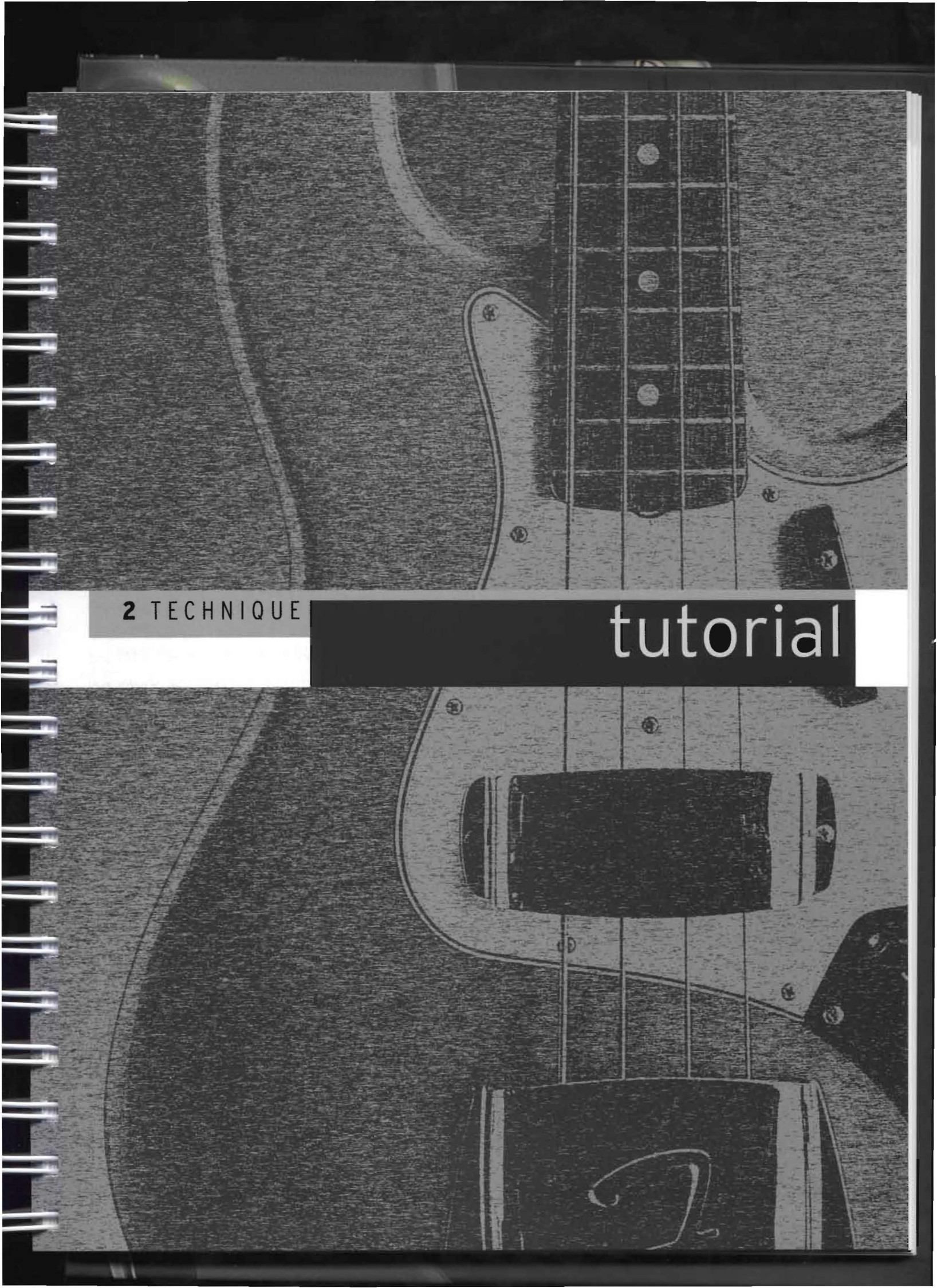
Me'Shell NdegéOcello.



Nick Oliveri of Queens Of The Stone Age on a Fender Precision Bass.

Wild and you'll hear where rock bass playing has got to in the early part of our new century. The fast and the furious melodic rockers, Muse, have been hailed as the power trio of the new millennium, and bassist Chris Wolstenholme is always keen to lay down both arpeggiated riffing based upon frontman Mathew Bellamy's classical influences and smoother, more flowing lines pumped up with analogue synth and octave-shift effects. The infectious grooves of 'New Born' from the band's Maverick release *Origin Of Symmetry* (2001) or the more technique- and effects-filled riffing on *Absolution* (2004) showcase his talent and appeal to a new generation of bassists.

Whatever next?



2 TECHNIQUE

tutorial

THE TUTORIAL SECTION *of The Bass Handbook* is intended to provide what you need to become a proficient bass player. Nearly every section is based upon overcoming the learning 'wall' that students tend to reach at some point in their careers. Whether you're a beginner, an intermediate player or someone with many years of bass experience, you may be stuck there. Often the best way to break through that barrier is by going back to basics; so you will find here exercises and tips on hand positions, fretboard knowledge, chords and scales, and creating basslines to fit certain musical situations.

The information in this section comes from a wide variety of sources. The majority is based upon practical work with student players. That way its success is easily monitored: most of these students are now working bass players. But there are also plenty of hints and tips from top bassists, including thoughts about ear-training, fretless bass, and much more. You can work through the chapters in order or simply dip in when the mood takes you. With sections on exotic scales, reading music, slap bass, and harmonics, there should be something for players at every level.

Most of the exercises here are presented in both standard musical notation, which is explained in the chapters on Basic Notation (p141) and Reading Music (p203), and tablature. Tablature is a system that shows you where to place your fingers on the frets. Each of the four horizontal lines in the tablature represents a string. The lowest corresponds to the fourth string: low E in standard tuning. The numbers on each line indicate the fret at which the string should be held down to produce the note written in the music immediately above it. Tablature includes no rhythmic information: for that you will need to use the notation. Tab is not used in professional circles, so it is worth learning to read music. For that reason, you will notice that tablature is not supplied for some of the more advanced exercises.

Most of the pieces of music here are labelled 'Exercise', which indicates that you should play them to hear what they sound like: only some of them are exercises designed to improve your technique. Some of the notation in the text is there to illustrate musical points: it can't all be played on the bass, although it can often be played on a keyboard, if you have access to one.

The accompanying CD includes many of the exercises, but not all of them. That's partly because there is a finite amount of space on the disc. But it is also to encourage you to work things out for yourself from the printed music rather than simply copying what you hear.

And now let's begin....

1. GETTING COMFORTABLE

Whether you've just picked up your first bass or have been playing for some time, it's important to take a look at your general posture so you can be comfortable playing the instrument. Poor posture can cause injuries; dealing with it quickly or by prevention should ensure many years of relaxed bass playing for you.

You can play the bass sitting down or standing up. Most performances will normally require you to stand, so many players advocate practising standing up; learning something sitting down and then wondering why all those licks aren't happening on stage is a common feeling with those experiencing live performance for the first time. Personally, I find it more comfortable to practise sitting down, although I will rehearse a repertoire standing up as well. One way to avoid this stand-up/sit down dilemma is to ensure you adjust your strap to a length that accommodates both postures.

One key to comfort is a good strap. Straps come in a wide range of sizes, materials, and styles. Although you're likely to be tempted by a particular design, comfort should be the priority. Material is usually webbing, leather, or neoprene. Webbing straps have the advantage of flexing very little while worn and over a period of usage. They are also strong and easily adjustable. For some reason though, most webbing straps are on the thin side, and bassists tend to prefer a wider strap to support the weight of the instrument. Planet Waves' Comfort Wide nylon straps, at 3" (74mm) wide, have filled this gap in the market.

Leather comes in the widest range of styles and sizes. Levy's makes a huge choice of straps including plenty of wider versions suitable for bass. Leather feels a little rigid and uncomfortable at first, but many hours spent settling it in will soon have the contours perfectly matching your back and shoulder. Moody leather straps even feature signature models for Mike Dirnt and Billy Sheehan.

The Comfort Strapp has been my choice of strap for many years, especially after an RSI (Repetitive Strain Injury), which I believe stemmed from shoulder tension caused by the substantial weight and poor balance of my main bass. The strap has a stretchy neoprene material that feels as if it's taking some weight off your shoulder, although that slight 'bounce' from the flex puts some players off. The rule for straps is the same as for a bass; try as many as possible. And don't be tempted to opt for the one that came free with the instrument. Planet Waves makes two padded strap add-ons, the Squid and the Shoulder Pad. These allow you to keep your favourite narrow strap but offer extra support at the shoulder. Here's a useful tip; if you carry your bass head in a padded bag these pads can be looped around the bag strap handle, nearly always a narrow affair, making carrying your head bag much more pleasant.

Whatever strap you use, a set of straplocks is a good investment. Straplocks attach to your existing strap and are then secured to the bass using special replacement strap buttons. Once secured, they should never come off inadvertently (the strap can still be removed at any time). If you've never had a bass crash to the ground because your strap has slipped off the button, I'm afraid it's just a matter of time. At best it's embarrassing (although it allowed me to practise some Ian Anderson-esque moves as I attempted to balance the bass on my knee mid-performance). At worst it ends up with a sizeable chunk out of the side of your bass. Schaller and Dunlop both make excellent and

SAFETY FIRST

One habit you might want to adopt is the pro's cable/strap loop. When connecting your bass to an amp, loop the cable once through the back of the strap and then down into the jack socket. If you step on your cable – or someone else does – it won't pull the plug out of the jack socket and kill your sound dead.

reasonably priced straplock kits. Ensure they are correctly fitted, and regularly checked for tightness.

Once you are comfortable with the strap adjustment, the bass should feel well balanced, your arms should be relaxed when holding the bass, and there should be no extreme angles on your wrists when playing. You might have this instrument around your neck for the next 30 years, so it makes sense to get this stage right.

2. TUNING

There's often great truth behind jokes, especially when it comes to musicians. A bassist returns his instrument to the store, complaining of it not sounding right when played with his bandmates. "Is it in tune?" asks the store assistant. "It was when I bought it," complains the player. And when the bassist of (insert your choice of band here) is spotted crying into his beer at the side of the stage, the drummer asks if everything is all right. "No!" wails the bassist "My roadie detuned one of the strings on my bass." "What's the problem?" inquires the drummer. "He won't tell me which string..."

Amazingly, it is fairly common for students to rely solely on electronic aids to tune their instruments. Tuners are wonderful devices, and we'll look at them later, but they should only be an extra to the basic requirement of tuning your instrument by ear.

Fifth-fret tuning

There are two popular tuning methods. The simplest involves matching the fretted notes to the open strings, often called the fifth-fret tuning method. If you don't have a reference for an open string (see below), at least your bass will be in tune with itself for home practising.

We are going to tune the four-string bass to standard E A D G tuning, with the fourth (lowest) string tuned to E, third string to A, and so on. If you play the E-string at the fifth fret you get an A, the same note as the A sounded by the open third string. Play the open A and let it ring. Whilst it is still sounding, play the A on the E-string and compare the pitches of the two notes. Start with the E string A too low and tune it *up* until the two notes sound the same. When the notes are close but not exactly the same, you will hear a regular 'pulsing' or 'beating'. Adjust your E-string until you no longer hear the beating.

Now fret the A-string at the fifth fret to produce a D note. Tune the open D-string until it matches that D. Finally fret the D string at the fifth fret to produce a G and tune the open G-string to that.

If you want to play with other instruments, the A-string should be tuned to standard pitch first of all. You can achieve this by using either a tuner (resisting the temptation to use it for the remaining strings, because it is essential to learn to tune by ear) or an A tuning fork, but that is a lot more tricky.

CD TRACK 1

Alternatively, if you have a CD that you know has a note you can tune to, use that; there are reference notes on the CD that accompanies this book (CD track 1). In a band situation, ask another performer – one who has tuned up – to give you a note, preferably an open A, that you can tune to.

Old, worn, dead strings make tuning difficult. Replace them if necessary. A common

mistake is to push down on the fretted string too hard. This bends the pitch and makes for inaccurate tuning. Remember, tune *up* to the note. If you go too high, don't try and retune down to the note, slacken the string till you are below the proper pitch and tune upwards again. Loose or malfunctioning tuning heads, sticking saddles, and badly cut nuts can cause tuning problems.

Harmonic tuning

Tuning using harmonics tends to give more accurate results. The factor of bending the string is eliminated and the harmonic can be sustained without your needing to leave your hand in position. For more on producing the harmonic, see Harmonics (p238).

Here's how it works. Play a harmonic at the fifth fret of the E-string. The harmonic produced is an E. Let the harmonic sustain while removing your finger. Now play a harmonic at the seventh fret of the A-string. The harmonic produced is also an E. Let the harmonic sustain while removing your finger. With both harmonics ringing, any tuning inaccuracy will be revealed once again by the 'beating' or 'pumping' produced by the interaction between the two harmonics. Because both your hands are free, it becomes an easier task slowly to retune the offending string, which should be the E-string if you have tuned your A-string to a reference tone. You will hear the beating slow down until it disappears and the two harmonics become indistinguishable from each other. That's when you're in tune. Repeat this for the remaining strings using the fifth fret harmonic of the A-string against the seventh fret harmonic of the D-string and the fifth fret harmonic of the D-string against the seventh fret harmonic of the G-string.

Just as in the fretted tuning method, old strings make this method much harder. You will still need to get one string, probably the A, perfectly in tune first. And the most common problem is to choke the harmonic so it doesn't ring. Remember to lift your finger off as soon as you've struck the harmonic.

Electronic tuners

The argument that you can live without a tuner altogether doesn't really hold today, although it is essential you learn to tune by ear as well. With a decent tuner, you can tune up in situations when it's almost impossible to be heard (on stage for example) or if you need to be silent before performing. It allows you to service your bass by making intonation adjustments, and with prices starting at a meagre £10/$15 it seems to make sense to examine what features a tuner should have.

TUNER TYPES

Tuners fall into three basic categories: the compact design for carrying in your pocket or gig bag; a pedal design to go on the floor with your effects set-up; or a rack-mount tuner for professional rack installation.

Most designs will be either manual or automatic, the former requiring you to select manually which string you want to tune, the latter automatically detecting which string you are trying to tune provided it is within a certain parameter. Another common feature is the chromatic facility, allowing you to tune open strings and all the notes in between, including sharps and flats. This is useful if you use drop tunings or altered tunings on your bass. Other functions may include the ability to adjust the reference pitch via calibration.

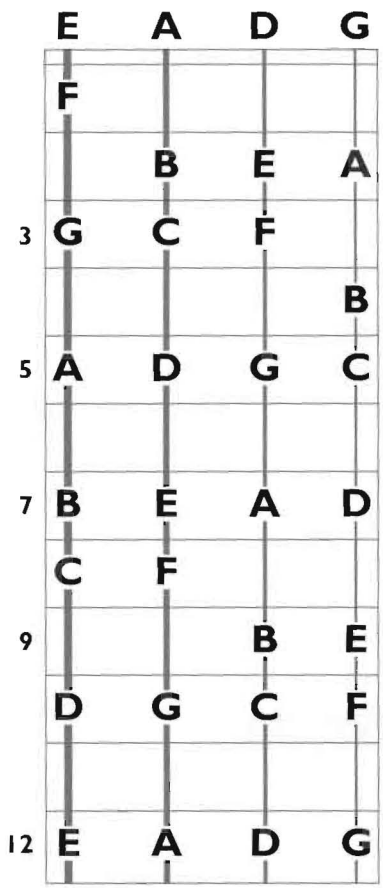
While A = 440Hz is the currently accepted standard, that hasn't always been the case and calibration allows adjustment for that (or the wonky old piano in the corner of the room).

The display should be clear and easy to read on a dimly lit stage. Options include LCD displays or backlighting that can be switched on or off. Boss uses an old fashioned VU-type needle display on some of its more expensive tuners, as many players prefer the stability of these displays. Some companies go for LEDs or a combination of both, for instance Korg, whose OT-12 features both needle and LCD displays. Try and see a few in action before deciding. You don't need a bass-specific model (they are rare these days anyway) but the range should be wide enough to cope with the low B on a five-string bass. Some budget models are very unstable with the low B-string and although you can play a harmonic to tune by, intonation adjustments will require a fretted note to be stable. Some compact designs add other features. The Boss TU-80 has a built-in metronome, for example.

Pedal designs, such as the Boss TU-2, Korg DT-10, and Rocktron Xtune, are designed to be placed on the floor and usually match the rest of the company's pedal designs. This is not the place to economise: a floor tuner will be trodden upon repeatedly and needs to be of sturdy design. The display needs to be clear when you are standing up and looking at it on the floor. Make sure your choice does this for you. One advantage pedal tuners offer is they usually allow powering by a mains adaptor (or daisy chaining from another power supply) and thus are unlikely to run out of power at critical moments. The Peterson StroboStomp incorporates a DI box in its pedal casing, a neat solution to the overcrowding of your pedal board, plus an output to power your other pedals.

Rack tuners are available for rack installation (see Bass Amplifiers, p78) and tend to offer very wide ranges, a choice of display modes between strobe and cents (one cent = 1/100th of a semitone) and various patching options. Pure strobe designs, such as the Peterson 490 strobe tuner, have graced many a pro's stage set-up for decades. Others, such as the Sabine RT7100, incorporate different channels for different instruments and channel routing. Surprisingly, few manufacturers offer a tuner built into an instrument or amplifier, Euphonic Audio being one exception. A Sabine tuner is featured on its iAmp800.

DIAGRAM 1



3. FINDING THE NOTES

The most popular bass is still the four-string version, tuned E A D G, although the five-string is accepted as a common alternative. The five-string adds an additional low B below the E-string or, less commonly, a high C above the G-string. The six-string incorporates both. Knowing the notes on the neck is the first stage in communicating your musical message to other musicians. The other way is to be able read music by sight, but as this involves knowing the notes on the neck anyway, let's start by learning and understanding the fingerboard.

Note finder

We need to find where the notes of the musical alphabet are located. The bass (along

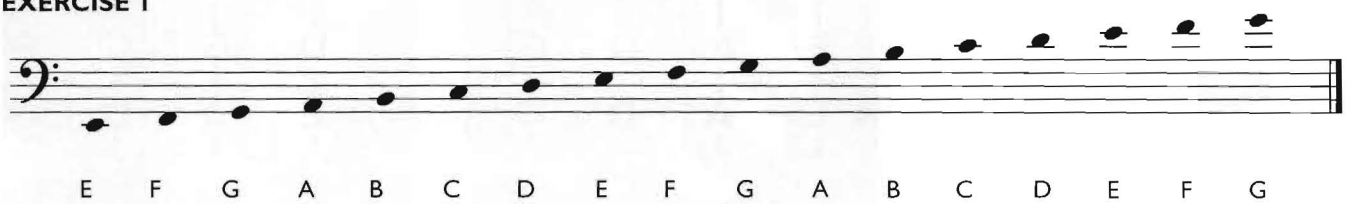
with all other Western instruments) uses a musical alphabet made up of 12 separate steps in pitch, known as semitones. The 12th step brings you to the octave of the starting note. You will recognise the octave because it sounds similar to the starting note, but higher. It has the same name as the starting note, and all the other note names are repeated after that until you reach the next octave. That way 12 note names cover the whole range of pitch both up and down from your starting note.

The natural notes are A B C D E F G; they are the white notes on a keyboard. The remaining five semitones come between some of those notes: they are the black notes on the keyboard. They are named as 'sharpened' or 'flattened' versions of the natural notes they are beside. The note between G and A, for instance, can be called G-sharp (G♯) or A-flat (A♭), depending on how it is used.

It will take you time and practice to discover the position of every note on your fretboard. I suggest learning it in stages. Start by becoming familiar with the open strings. (You can play a blues progression, by the way, by just using the open strings: A D E.) Then try learning the natural notes from Diagram 1 (left). This omits the sharps and flats. Try playing some of these notes on your bass. See how and where the same note occurs more than once.

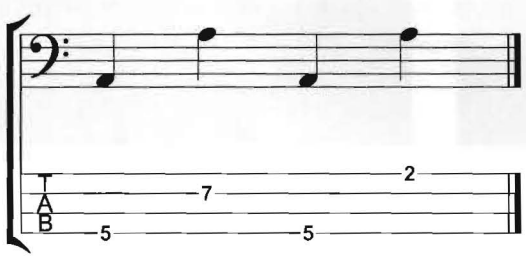
Exercise 1 shows those natural notes in musical notation, starting with the open E at the bottom and ascending to the high G at the twelfth fret of the G-string.

EXERCISE 1



One way of exploring the fingerboard is to find the octave of a given note. Exercise 2 shows two ways to find the octave of the note A; if you are using standard tuning you can use the same fingerings to find the octave of any note. The exercise uses both musical notation and tab, which shows you where to place your fingers. The first fingering means fretting the fourth string at the fifth fret, and the second string at the seventh fret. The second fingering means fretting the fourth string at the fifth fret again, and the first string at the second fret.

EXERCISE 2



Observe the following: the notes of the open strings, A D G, can also be played as fretted

NAME THOSE NOTES

Learning notes randomly might appear rather dull. Try this neat exercise recommended by Steve Bailey, the US session ace. Play up and down each string, a semitone at a time, and then stop when you hear a sound; for example, a car passing by, people talking in the street, the doorbell, etc. Take that as your cue to look down and immediately identify the note you are playing at that moment. As you improve, you can try and name the notes you are playing without looking at your fingerboard.

DIAGRAM 2

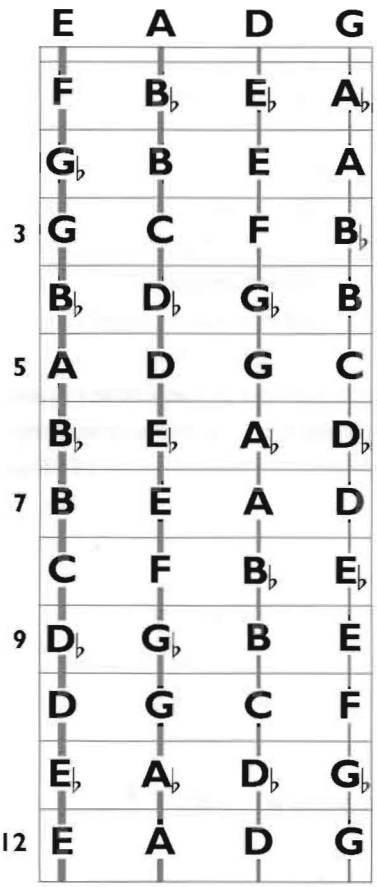
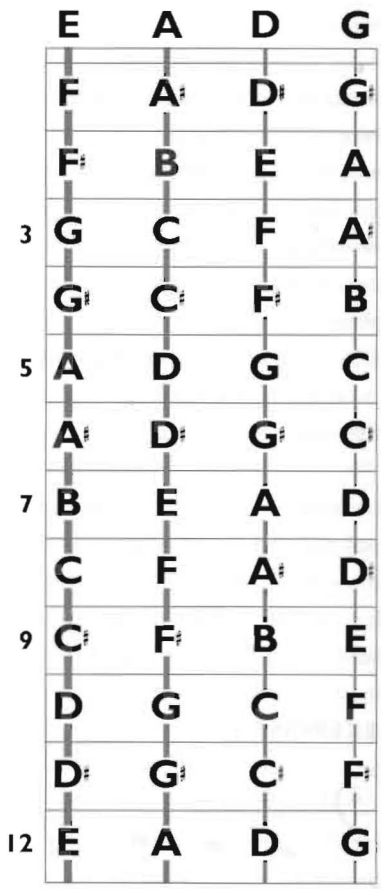


DIAGRAM 3



notes. The low E can only be played an octave higher as a fretted note: low E is our lowest note (on a four-string bass). Other notes are repeated many times on the fingerboard. You will notice that all the note names are two frets (a tone) apart, except E and F, and B and C, which are only one fret (a semitone) apart.

Diagram 2 (above) is the same fingerboard. This time, as well as the natural notes, the diagram shows the remaining notes (the black notes on the keyboard), labelled as flattened notes.

Diagram 3 is the same as Diagrams 1 and 2, but this time the notes in the gaps between the natural notes are labelled as sharpened notes.

Although each natural note has its own unique location, a sharp note and a flat note can share the same fret position. When two notes sound the same but can be written in two different ways, they are said to be enharmonic.

4. THE FRETTING HAND

Getting the most out of your fretting hand has many positive advantages. Good hand positioning can help with finger independence and general technique. Chords and basslines become easier. It avoids repetitive strain injuries, and it can make sight-reading appear less daunting.

Supportive fingering

One complaint I hear a lot from bass students is that they can't seem to get a good sound from their instruments, despite playing around with all sorts of gear. Often the answer is to develop a good fretting-hand technique to prevent the sound becoming choppy and lacking in punch. Supportive fingering is a concept that will help strengthen your fretting hand and give good dexterity. The starting point is to achieve a fretting-hand position in which each finger is holding down one fret. As with all good 'rules', there are exceptions: repeating octave or root/fifth patterns, extended fingering, and double bass technique are all examples. But the supportive fingering approach is useful even in those situations.

Figure 1
With the thumb relaxed and in position, our first finger is in the correct place, pushing the string down right next to the fret. Note the remaining fingers in an arched position so they are ready to play the next notes.

Figure 2
When we place our second finger down, note that the first finger remains in its place, as in Figure 1. In other words, don't lift it up from the fingerboard. Our last two digits are hovering in place ready for the next note.

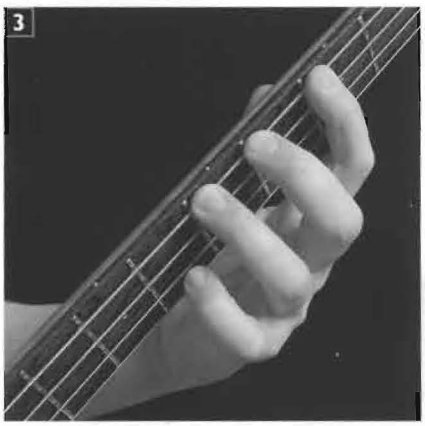


Figure 3
With our third finger fretting the third note, the principle of keeping the first two fingers down becomes harder. You may find at this point that you want to lift your first two fingers away from the fingerboard. This will lead to a less well-defined tone and should be avoided. Just being aware of the situation will make it less likely to occur.

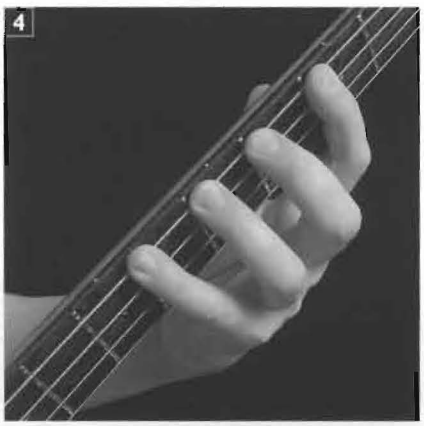


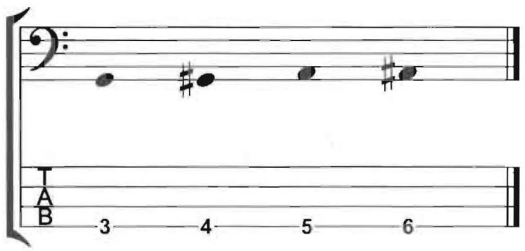
Figure 4
With our fourth finger playing the fourth note, each finger is right next to the fret for the best tone and position. Remember that each finger behind the fourth finger must remain down to achieve supportive fingering. Take these first four steps gently, and rest if you experience any pain.

Look at Figure 1, which is played on the E-string. In the example shown, the exercise is starting on the note G, which is fretted by the first finger. The remaining fingers are arched and ready to play over the next three notes on the fingerboard, even though they aren't actually playing the notes.

The thumb is placed behind the neck, about half way round, and sits directly under your first or second finger. The fretting finger lies just very slightly behind each fret; not directly on the fret and not between the two frets, because either of these positions can cause fret buzz.

Figure 2 shows the second finger playing the G♯. Figures 3 and 4 complete the exercise. Exercise 3 gives you the notation and tab you will need to play it.

EXERCISE 3



The supportive fingering element is achieved by leaving the previous finger down as each new note is played. In this case, when playing the G♯, the first finger still holds down the note G.

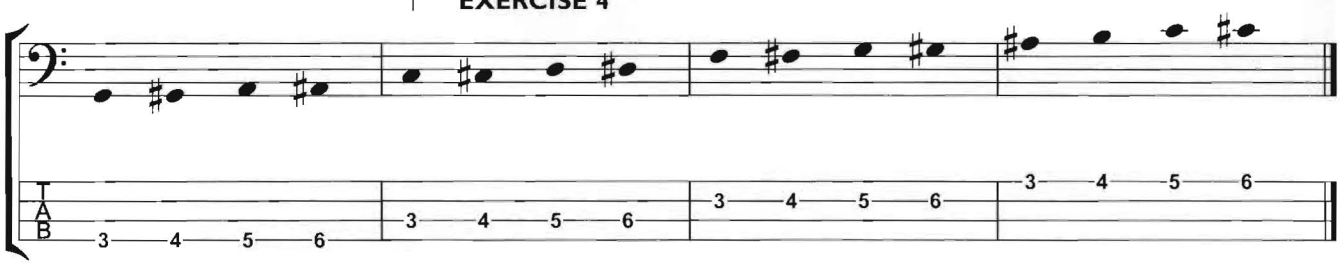
Did your first finger want to lift up when you played the G♯? If so, it's important you only focus on supporting one or two notes before completing all of the exercise. Do not expect to master this technique immediately. It comes with practice and time. Six months to a year of gradually applying the technique (while practising other material as well) is certainly nothing to be frightened of. When you have played the exercise on the E-string, repeat it on the remainder of your strings.

You should only attempt this exercise one step at a time. If you feel discomfort or pain, then it's time to stop and gently shake your hand out. I'm not a believer in the "no pain, no gain" concept; but practice does make perfect. Just take it one step at a time.

If you find the exercise too hard starting from G, then shift it up several frets. The higher up the fingerboard you travel, the closer the frets and the easier it becomes. Practise this slowly and you'll find some of the later exercises and techniques will become a lot easier.

If you want to take this approach one step further, then you can check out Exercise 4, a classic called the spider exercise.

EXERCISE 4



This starts in the same way as Exercise 3, but when you have reached the position shown in Figure 4 (above), with all fingers in place, move across to the A-string. The

important thing is leave all your fingers in position on the E-string except the one that is moving across to fret a note on the A-string. Remember to take it gently; have patience... Figures 5 to 8 show how this works. Carry on across the strings until you end up on your G-string (or C-string for six-stringers). Remember, it's easy to cheat on these exercises by lifting the fingers that should be held down. That would not be supportive fingering and would defeat the whole point of the exercise.

Figure 5
Start in the position you reached in Figure 4 (above). Now move just your first finger across to the A-string. The fingers that are in position on the E-string remain in place. This is the essence of supportive fingering.

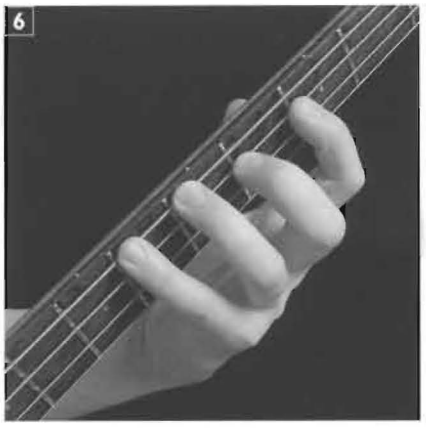


Figure 6
Now the second finger moves across to the A-string. The importance of a slight curvature to the fingers becomes clear; if you don't do it, you can't play the next note in the sequence. At this stage, both notes being fretted should be audible.

Figure 7
As your third finger moves across, your little finger will want to pull away off the E-string and follow it. Don't try and cheat by playing the exercise fast. Take your time practising; and again, if you feel any pains, drop your hand off the fingerboard and rest it.

Figure 8
When you have all four fingers on the same string once again, repeat the exercise for the rest of your strings and across the fingerboard. The supportive fingering technique will help your independence and ensure solid tone. If you practise it on a fretted bass, it will also help with intonation should you ever try fretless bass.

Further techniques

Two more fretting-hand techniques are the hammer-on and pull-off. These use the strength of the fretboard hand to play notes without using the plucking hand. As well as being great exercises for improving finger independence they will embellish any bassline or solo. Their use in slap bass is very common.

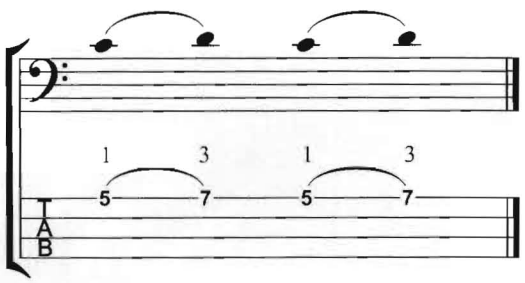
THE HAMMER-ON

Here, the note is played by a finger on the fretting hand hitting the string with enough force to sound a note. It tends to sound softer than if it were played by the plucking hand. The fretting hand holds down a note with one finger and 'hammers' down hard with another finger on a note above, making it sound. Alternatively, you can hammer on to an open string. Often the hammer-on is preceded either by a pull-off or by a fretted note being played.

Exercise 5 shows a hammer-on from the first finger to the third, the most common approach. You will need to pluck the first note in each pair, or, when you have built the strength of your fretting hand, hammer it on from the open string.

CD TRACK 2

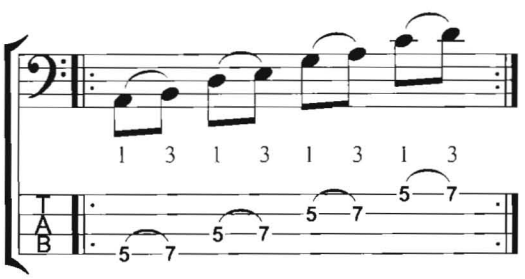
EXERCISE 5



Exercise 6 moves the hammer-on technique across the strings.

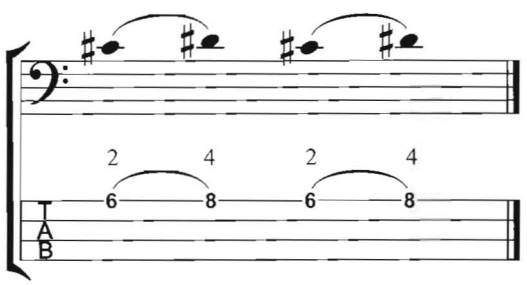
CD TRACK 3

EXERCISE 6



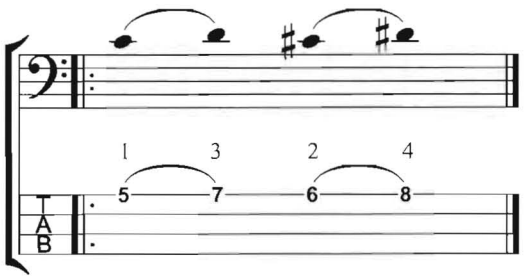
Exercise 7 involves a hammer-on from the second finger to the fourth, which is a little trickier because of the weakness of our fourth fingers; this exercise should help to overcome that.

EXERCISE 7



Exercise 8 combines both exercises, the aim being to keep your hand in the same position and to make all the notes sound smooth and even in dynamics.

EXERCISE 8

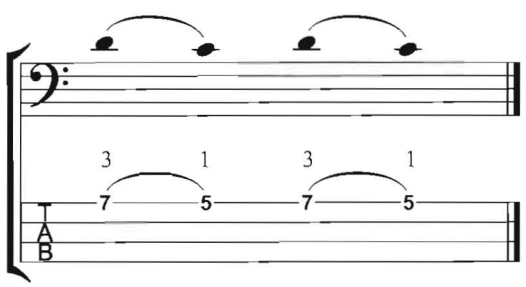


THE PULL-OFF

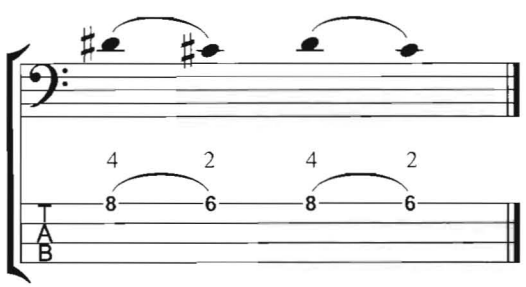
This feels like a hammer-on in reverse, but the technique is slightly different. The pull-off starts with two fretted notes held down. The finger on the higher of the two frets then pulls away to sound the note below, which could be a semitone or more below the first note. Some students question this; how can you sound a note by lifting the finger *off* the string? The answer lies in the name. You are plucking the string by a slight downward motion away from the fingerboard. Exercises 9 and 10 will help you develop the technique.

EXERCISE 9

CD TRACK 4



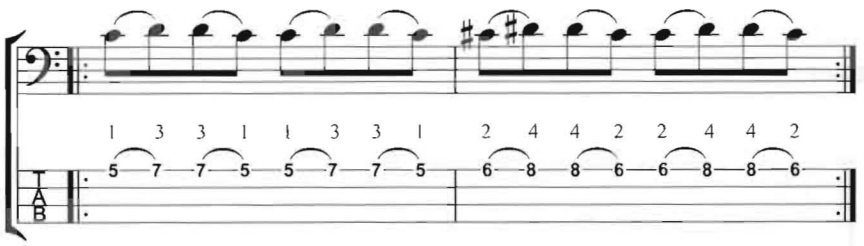
EXERCISE 10



Exercise 11 combines hammer-ons and pull-offs. You should be able to play this exercise without using your plucking hand at all, although it takes some practice to execute cleanly.

CD TRACK 5

EXERCISE 11



Repeating either the hammer-on or pull-off gives a neat trilling type of effect, a useful 'jump' to walking basslines to give rhythmic movement, or they can be combined with two-hand tapping for fast speed runs.

EXTENDED FINGERING

This is an advanced finger reach technique and not to be attempted until one feels very relaxed and comfortable with all of the above. Extended fingering involves playing licks and riffs by stretching more than one finger per fret. For example, starting at A on the E-string, a one finger per fret stretch is used to cover A, A♯, and B. The fourth finger is then extended to play the C♯. Sometimes you can achieve this while maintaining the existing positions, sometimes your first finger may need to shift a little. The advantage of such a system is that it gives a major third reach up one string, a useful technique in many riffs.

5. THE PLUCKING HAND

Background

With our fretting hand in position for maximum comfort and ease of playing, it's time to get those notes out of the bass by examining the plucking hand. Bassists have used all manner of techniques to pluck the notes of a bass. Early basses placed a finger-rest at the bottom of the bass body to support the fingers while the thumb was used to play downstrokes. With the flatwound strings of the day, a dull, upright-like tone could be achieved. No surprise there; after all, the electric bass came into existence to offer an alternative to the old 'doghouse'.

It took until 1974 for Fender to move the rest from the lower bout to the upper part of the bass, reflecting the trend of bassists to use it as a thumb-rest, which is what it is now called irrespective of location. Many players adopted a single-finger approach to bass. The most famous of these was James Jamerson, the Motown player, who could execute incredibly rapid and melodic basslines this way using his index finger, which he called The Hook.

Players soon realised that by alternating two fingers one could halve the workload of one finger, or... play twice as fast. John Entwistle adopted this technique with The Who, although he got the idea watching someone else, as he explained in an interview with *Bass Guitar Magazine*: "I saw a bass player supporting us who was using his first and his second finger, but not both at once. So I thought I'd use both at once. Later on the same bassist came up to me and said he was influenced by my two-finger style and I said, 'Well,

it came from you!' He said he only used two fingers because he had a blister on one." In the fusion-obsessed 1970s, the alternating-finger style became standard. An alternative was practised by Chuck Rainey, session bassist with Steely Dan and The Jackson 5, with his one-finger back-and-forth technique, whereby one finger strikes the string on a downstroke and then returns on an upstroke to play the next note, replicating the feel of a plectrum player but without the plectrum itself. The alternating sound between nail and soft flesh creates an interesting and alternative sound.

As guitarists discovered two-hand tapping, popularised by Eddie Van Halen, speed limits on the fretboard rose considerably and bassists replied by adopting three-finger techniques. Accompanying Steve Vai led Billy Sheehan to pluck using his three fingers, leading from the ring finger first, as if tapping down on a desk. Session and fretless ace Steve Bailey uses three fingers, but leads from the index finger. Groupings of four notes mean there will be a different leading finger on each downbeat, unless you opt to use index, middle, ring and then return to the middle finger for beat four. Gary Willis created a three-finger technique, but only using two at any one time; the finger not being used remains in situ to play when required or to dampen the strings. Some players use all the fingers (and thumb) of their plucking hand. Playing downbeats with the thumb and then plucking with two, three or even four fingers, but as a fingerstyle technique rather than a slap one, is an approach used by bassists such as Abraham Laboriel and Alexis Sklarevski.

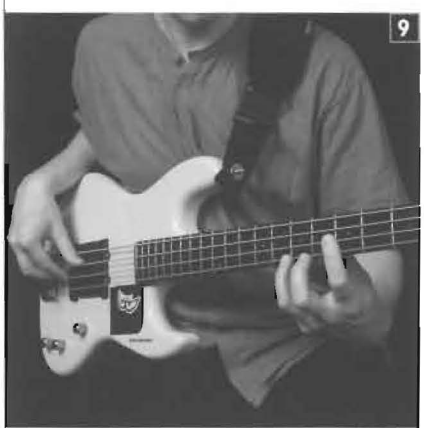


Figure 9
You can really change your sound by altering where you pluck the strings. Try this position, close to the bridge.

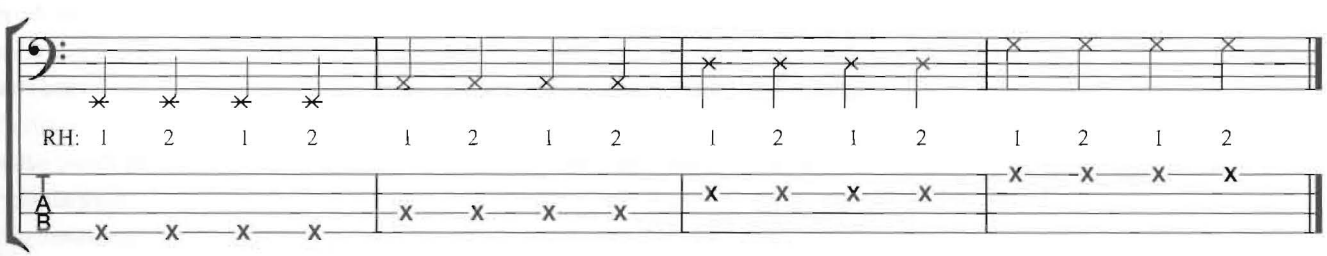
Alternate fingering

Whichever method you finally choose, it's accepted that alternate fingering of the plucking hand is the place to start. All the other methods are seen as advanced and alternative techniques to which you can progress.

What is commonly accepted is that the plucking fingers should be strictly alternated, and this is harder to achieve than it might seem. Try using different locations for the thumb so it provides support for the alternating fingers. It may be anchored on the bass, it may float (see p140) or it may rest on the E-string, moving across when you play the G and lifting off when you play the E. Where you pluck the strings can really change your sound and the feel of the string underneath your fingers (Figure 9). Try it yourself and see. You can start your alternating fingering on either finger, index, or middle.

Exercise 12 demonstrates how to pluck deadened notes on the bass across all four strings. Deadening the strings is achieved by laying your fretting hand across them with just enough pressure to stop them sounding as actual notes. This is useful because it helps focus all your attention on the plucking hand.

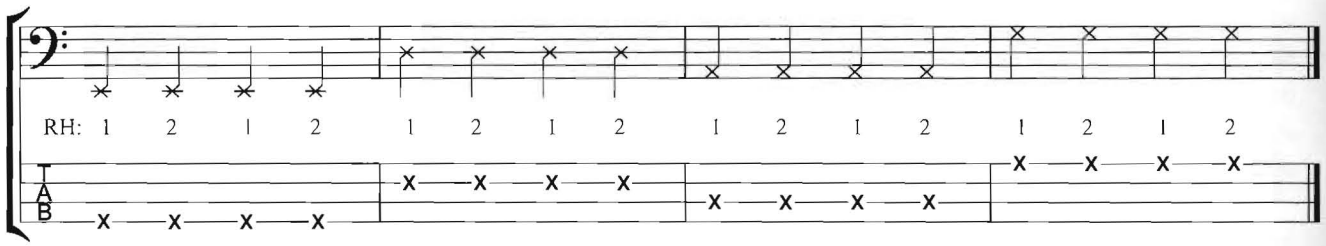
EXERCISE 12



Exercise 13 involves crossing strings.

CD TRACK 6

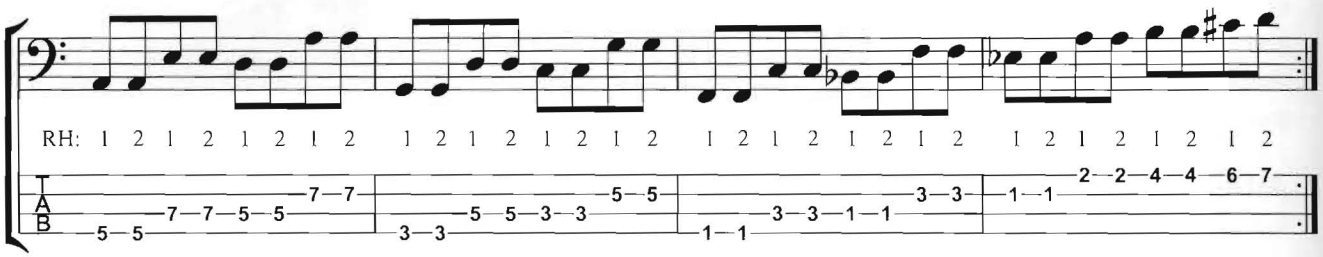
EXERCISE 13



Now sound the notes by removing the left hand that is deadening the notes. When playing these open string exercises, try muting the strings (see opposite) that aren't being played, to prevent them ringing. Exercises 14 and 15 give basic patterns to warm up with, with the emphasis on crossing the strings.

CD TRACK 7

EXERCISE 14



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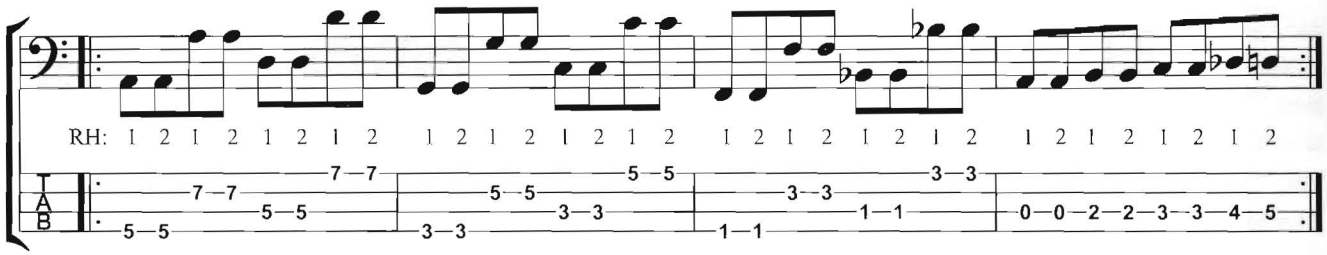
EXERCISE 15



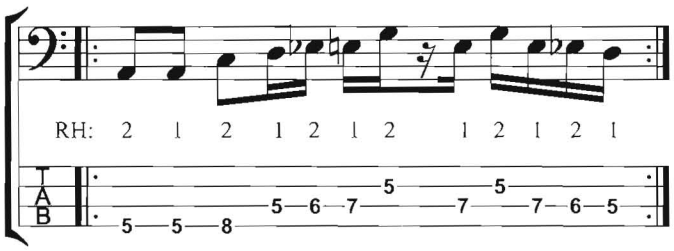
Watch that you don't use a technique called raking to play down across the strings. Raking involves dragging your finger down across the strings to play the fretted notes, a valid technique in itself but not required here where the focus needs to be on strict alternation of your fingers. If this seems difficult at first, do persevere. Bassist Jeff Berlin once compared alternate plucking to walking down the stairs – once you learn to go down one step at a time alternating each leg it seems like second nature, but if you don't... Well, it's best not to even try, but I can imagine you'd end up a crumpled heap on the floor.

When you have mastered reading (Basic Notation, p141, and Reading Music, p203), come back and try Exercise 16. This is based on the bassline played by Living Colour's Muzz Skillings on the tune 'Open Letter to a Landlord' (from *Vivid*). The exercise is virtually impossible to play cleanly unless strict alternate fingering is used. I find it also

works better starting on the middle finger, alternating middle and then index. Practise slowly and then fast riffs like this won't seem so daunting.

EXERCISE 16

CD TRACK 9



Plectrum

Paul McCartney, Chris Squire, Anthony Jackson, Steve Severin (Siouxsie and the Banshees), Mike Dirnt; all different players but all using the pick. Using a plectrum (or pick) gives a very distinct sound to the bass, and is something you should always try. Sometimes it's forced upon you because of blisters acquired through practising with your fingers. Most bassists tend to prefer a heavier gauge pick of 1mm or more. There are many different sizes, materials, and finishes, so it might be a case of experimentation before you find the one that suits you.

Most picks are made from a plastic-type material similar to a pickguard. Surface finishes may be matt (Dunlop Tortex) or smooth (Dunlop Nylon), the former getting grippier once drenched in sweat, a useful bonus. Some surfaces are rippled for grip (Pick Boy) or have a rubberised surface over the regular material (Planet Waves Surepick). Other materials include exotic wood or bone, as favoured by Dugain, some with deep recesses for the thumb to grip. Techniques for plectrum involve either repeated downstrokes or alternating strokes. Each gives a different feel and sound, with the downstroke method favoured by many metal players for speed playing because of its aggressive tone and style.

Muting

When I was first asked how I mute strings, I actually had no idea. I had in fact been using several different methods subconsciously to deaden the strings I wasn't playing. Muting is just that: deadening the strings that aren't producing notes so they don't ring out and clutter up your sound. Can the strings ring on if you're not playing them? Yes, in two ways. Firstly you may be hitting the strings with your fingers through lazy technique. At amplified levels, the slightest touch of a string can cause it to sound out. Secondly, even if your technique is well-honed, just playing the strings you want to hear causes the whole instrument to resonate. Those resonant tones (good vibrations) can set off the other strings in sympathy (bad vibrations). While this may be overlooked during the energy of a live performance, during recording it can cause major problems. Either way, you will need to fix it.

The first method to fix this problem is rarely mentioned – you simply need to be aware of it. When someone pointed out the problem to me (during a recording session)

I had no idea of the various methods to fix it, but just by being aware of it, I developed systems to put it right. Once you are aware of the problem, you can apply several muting techniques.

ANCHORED THUMB

Whilst many of us anchor our thumbs, this can sometimes cause strings to ring on inadvertently when we move away from the lower strings. Moving our thumb onto the lower strings, and using them as the new anchor point when playing the higher strings, mutes the lower strings until we need to play them again. Then we move the thumb back into position.

FLOATING THUMB

This method has the thumb moving across the strings without anchoring it on the lower strings, and is useful in fast passages. Imagine the thumb being attached to a rail that travels at 90 degrees to the strings, with your fingers plucking away freely beside it. As your fingers move up or down the strings, the thumb travels alongside them (Figures 10 and 11). Not anchoring the thumb tends to mean lighter plucking strokes and less fatigue.

Figure 10
In the floating thumb technique, the thumb follows the plucking fingers as they move across the strings.

Figure 11
Alternate fingering: note that after the first finger has plucked the string, the second finger is in position.

FRETTING HAND

In combination with the above methods, the left hand may also be employed to rest lightly on strings that aren't being used, especially when playing open strings.

THE STRING MUTE

Although rarely seen today, many vintage instruments, such as the early Fender Jazz Bass, Music Man StingRay, Gibson EB-3, and variants, employed string mutes consisting of felt pads that could be rested against the strings with enough pressure to reduce sustain but not enough to deaden the note. Initially the idea was to reproduce the woody thud of an upright bass; but using them to mute the strings produced an alternative sound for electric bass and helped prevent strings ringing on. Occasionally a small piece of foam inserted under or over the strings at the bridge can help reduce unwanted string ringing in studio environments, providing the loss of brilliance is acceptable.

6. BASIC NOTATION

Why is it that the word 'theory' can instil so much fear into the hearts of bassists? I've got a theory myself. When they consider such subjects as harmony, theory, and reading the dots, the authors of music books try to compress a lifetime's work into a few pages. This tends to cause information overload, meaning the reader can swiftly lose interest. There appears to be an assumption that readers are immediately ready to try some cool, groovy basslines after only the briefest introduction to musical notation. Apparently, it's all so easy. Just count "One-and, two-and, rest, one-e-an-a, then slide up to the high G at the fourth fret, etc..."

Does this sound familiar? Have you had a go, discovered that, actually, you *couldn't* play the line, and then decided to give up there and then? "Hey who needs to learn harmony and theory anyway? What's important is whether I can get that record deal."

But no handbook can omit theory. Many players use it very successfully – although they'll often deny it, because it's not seen as hip. A little knowledge really can take your playing to a new level. Just get comfortable with one concept before moving to the next.

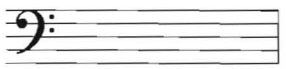
Having discovered where some of the notes are on our fingerboard, we need to start learning the language of music. It stays fairly basic here; more advanced notation appears in the Reading Music section (p203). There are also numerous books, some of them excellent, that will take you further: see Recommended Books And Video (p245). But whether you are a first-timer, or an old hand who has never bothered with theory, the secret is to get to grips with the principles before moving on to more advanced material.

Tablature is no substitute for musical notation. You will not find it used in professional situations, where sight-reading skills are required. But it is widely used elsewhere, and is particularly favoured on the internet. It is included with many of the exercises here, but not in the sight-reading section. Tab helps by showing you where to place your hands for particular notes, because the same note can be found in several places on the fingerboard. On the other hand, it has the serious drawback that it does not communicate the rhythm of music.

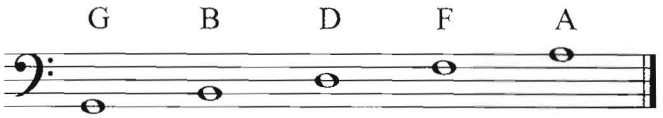
Sound and silence

Music consists of both sound and silence, so let's look at how these are correctly indicated in notation. Both pitch and rhythm are written on the stave (or staff – both terms are used), which is a set of horizontal lines and the spaces between them. The Great Stave, which is used for piano, has two groups of five horizontal lines, one above the other. Other instruments use only the top, bottom or middle part of the great stave, depending on how high or low they sound. High notes are at the top of the stave, low notes at the bottom.

Music for the bass is written on the bottom five lines of the Great Stave, which includes the bass clef. That's the symbol at the start of each line of music in this book. It represents an old form of the letter F; it indicates that the note F lies on the line between the two dots just to the right of the symbol. The stave used for bass is generally called 'the bass clef':



Reading from bottom to top, the lines in the bass clef represent G B D F A. The spaces between the lines represent A C E G. Some beginners use little phrases to help them remember the notes:



Because the five-line stave doesn't cover the range of most instruments, it can be extended with extra lines, under or through a single note, at top or bottom. These are called ledger lines. The bottom note of the bass guitar, low E, appears on a ledger line below the bottom line of the stave:

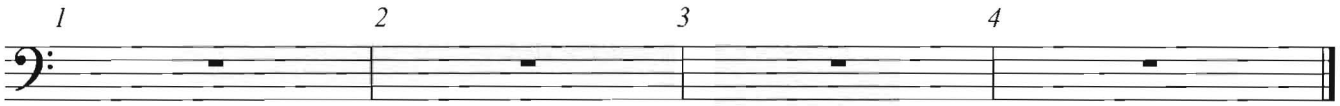
Music for bass guitar is written an octave above its actual sound, as you will discover if you ask a pianist to play that low E at the same time as you. This is so that its lower notes appear on the stave rather than on a whole ladder of ledger lines below it.

Rhythm

Music isn't just pitch; it's also rhythm, which determines when we move from one note to the next and when we play nothing at all. Musical notation has to tell you when a note stops and starts and how long it lasts. But the rhythms of tunes and riffs always relate to a regular pulse or beat, like the heartbeat, or the sound of the feet in marching.

The individual beats that make up this pulse are generally grouped, with a stronger beat at the start. They might sound like this: ONE two three four ONE two three four, and so on. That's called the music's metre. The stave is divided into bars or measures, each of which represents one of those groups of beats. They are separated by vertical barlines across the stave. Note that you start your count again at the beginning of each new bar.

The bars are also important so that you know where you are and can make easy reference to any point in a score or chart, which is the music for a whole song or other piece of music. Each bar has a number, although that number is usually only shown for the first bar on each line, rather than on every bar as it is here:



Look at the music exercises throughout the book. Count the stave lines and spaces. Where do you find lots of examples of ledger lines? Where do you find few examples of ledger lines? Don't worry about reading the exercises just yet. Get comfortable with their appearance.

Rhythm is represented by notes and rests, representing sound and silence respectively. Each note or rest has a particular value or duration. Learning to recognise these at sight is the key to gaining good reading skills. Once you know what the individual notes and rests stand for, you can work out rhythms. Soon you will be able to recognise and play common rhythmic patterns without having to puzzle them out. In time you will see how those patterns link together to form whole rhythmic phrases, without having to think about it; then you'll be playing at sight.

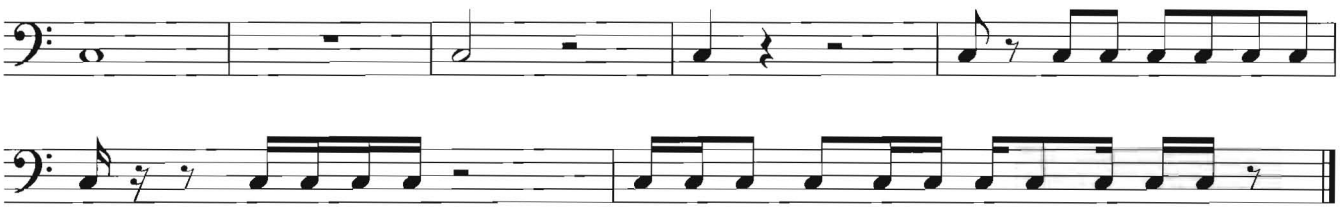
Take a look at Exercise 17. Here we have each of the basic note values, immediately followed by an example of a rest of the same duration.

This exercise is in 4/4 time (we'll get to that), meaning that each bar has four beats. In notation, the time represented by one bar has to be accounted for, by notes, rests, or some combination of the two. You can see that principle at work in the exercise. If you have a metronome, set it running at a slow speed and count the beats in groups of four. Otherwise, count and tap your foot once on each beat.

This exercise is played on the CD, which will help you relate the sound of the rhythmic patterns to the way they are notated.

EXERCISE 17

CD TRACK 10



Bar one shows a whole-note. This lasts four beats, filling the whole bar. That means that the note is sustained for four clicks of the metronome or a count of "ONE two three four". The rest in bar two is a whole-note rest that also lasts four beats. That means you keep quiet for four beats! In Britain, the classical name for this note or rest is a semibreve. Note that the semibreve rest hangs down from the line.

Bar three shows a half-note. This lasts two beats: two clicks of our metronome or a count of "ONE two". The rest that follows it in bar three is a half-note rest. It also lasts two beats, through the "three four" of your count, and consequently fills the rest of the four-beat bar. Note that the half-note rest sits up from the line. The classical name for this note or rest is a minim.

Bar four's first beat shows a quarter-note. This lasts one beat. The rest following immediately is a quarter-note rest and lasts one beat. Because there are four beats per

bar, and our first note and rest only add up to two beats, the rest of the bar has been filled with a half-note rest. The classical name for a quarter-note or quarter rest is a crotchet.

Bar five shows an eighth-note. This lasts for half a beat. We would play two to every metronome click if we were repeating eighth-notes. To count in eighth-notes, we divide each beat into two equal halves, like this: "ONE & two & three &" etc. The rest following the eighth-note is an eighth-note rest and lasts half a beat. So the note falls on "ONE" and the rest falls on "&".

Eighth-notes that are written in succession are often 'beamed' as shown, meaning their tails are joined together. The start of the beam indicates where each beat begins. The note stems may go up or down depending on the pitch of the notes and their position on the stave. The classical wording for this note or rest is a quaver.

Bar six illustrates a single sixteenth-note. This lasts a quarter of a beat, or four to every metronome click. The rest that follows is a sixteenth-note rest, which also lasts a quarter of a beat. Together they add up to half a beat, so to complete the bar we need another three and a half beats. Can you see how that's made up? We have a further eighth-note rest, followed by four double-beamed sixteenth-notes (beamed in the same way as eighth-notes but with two thinner beam lines), and finally, a half-note rest. The classical name for the sixteenth-note or rest is a semiquaver.

To count sixteenth notes, we divide each count into four, using a couple of extra little syllables. We count "ONE-e-&-a, two-e-&-a" etc. If the beat is divided into four even sixteenth-notes, we play a note on each of the syllables.

To notate many of the rhythms found in music, it's necessary to combine sixteenth-notes and eighth-notes. Once again, beaming makes them easier to read. Note that the usual rule about the direction of note stems does not apply when notes are beamed; they all go the same way.

In bar seven, there are patterns combining sixteenth-notes and eighth-notes on each beat. Look at the double and single beams to understand when the note lasts a sixteenth or an eighth in duration. When it lasts an eighth-note, we can omit the special sixteenth-note syllables in our counting. Beat one is read sixteenth/sixteenth/eighth. You count that "ONE-e &". Some people prefer different syllables, using a different "word" for eighth-notes and sixteenth-notes. In this case, beat one could be read as "ta-ta tum". Beat two is eighth/sixteenth/sixteenth: "two &-a", or "tum ta-ta". Beat three is sixteenth/eighth/sixteenth (study those beams). This is slightly more complicated to work out: "three-e… a", with the note played at "three", "-e" and "-a" but held over the "&". Or you could read it as "ta-tum ta". Beat four is sixteenth/sixteenth followed by an eighth rest: "four-e (&-a)", with "&-a" silent; or "ta-ta (tum)." Although the rests indicate a silence, it is important that you still count them or 'play' them mentally, so that you stay in time with the underlying pulse of the music.

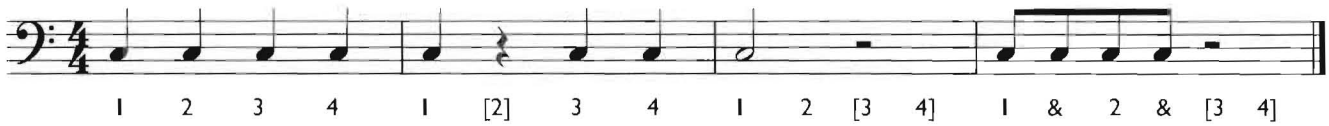
Reading rhythm is by far the hardest aspect of reading music, and there are more complications to come, in the Reading Music section (p203). For now, work slowly. Concentrate on keeping the underlying beat steady while you count and play or sing the rhythms over the top. Try not to pause between bars. Increase your speed as you grow more confident, but at this stage it is more important to be accurate than fast.

Time signatures

At the beginning of a piece of music, the rhythmic pulse is shown by the time signature. The time signature consists of two numbers stacked vertically above each other. The upper number indicates the number of beats per bar, while the lower number indicates the note value or duration of each of those beats. Look at Exercise 18. The time signature shows an upper number of four and a lower number of four, representing four beats where each beat lasts a quarter-note (or rest). Millions of songs have been recorded in this time signature! It is also known as common time, and can be represented by a 'C' in place of the time signature.

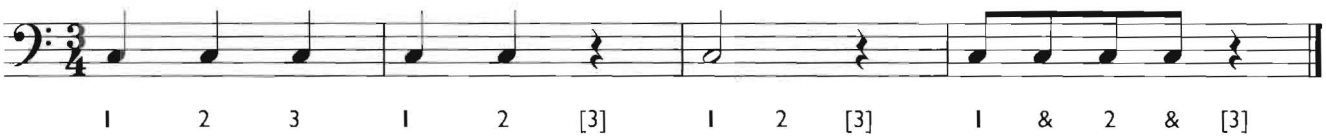
In the four exercises that follow, the numbers below the line indicate the basic beat: the pulse or metre of the music. The counting syllables mentioned above (ONE &, two-e-&-a, etc) are used here to show you how to play the notes that don't fall on the beat. The first beat of each bar is marked in bold type. When notes last longer than one beat, you hold them until the arrival of either another note or a rest. Rests are silent, but you still have to count so you can positively register or 'play' them, at the right time and for the right duration. The figures and syllables in brackets show where the rests fall. Note: none of this extra counting information appears in real music.

EXERCISE 18



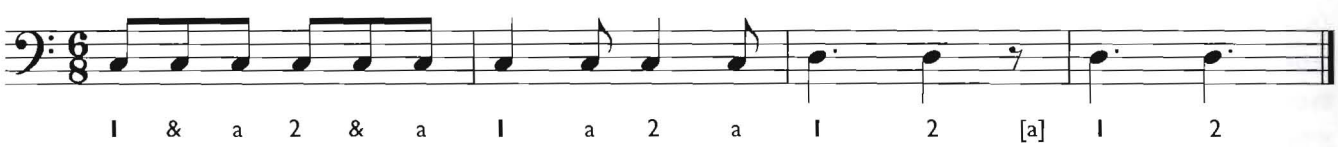
Exercise 19 shows an upper number of three while the lower number remains at four. So now we get three quarter-notes per bar. This is called 3/4 time. The classical waltz uses this time signature, but it is also found in many other musical styles. Go and find a copy of Jimi Hendrix's 'Manic Depression' for some full-on, rocking 3/4. It is counted ONE two three, ONE two three, etc.

EXERCISE 19



Exercise 20 shows an upper number of six and a lower figure of eight. That means we have six beats, each lasting an eighth-note. This is called 6/8. Those six beats are divided into two groups of three. So the strong pulse of 6/8 is in twos, and it is counted in twos: ONE two, ONE two, etc. Extra syllables are used to clarify rhythms that bring out the original six beats within the main pulse: ONE-and-a, two-and-a, etc.

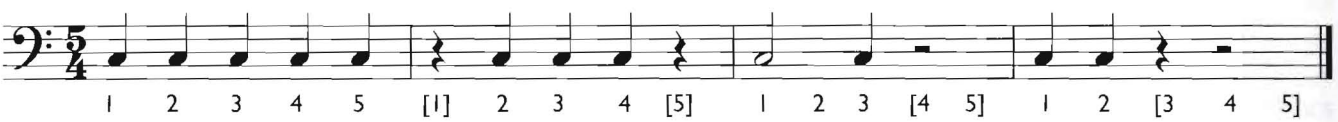
EXERCISE 20



Note that 6/8 is not the same as 3/4. A 3/4 rhythm is counted in threes: ONE two three, ONE two three, etc. A 6/8 rhythm is called a compound metre, because it joins two sets of three beats. Another compound metre is 12/8, which is made up of four sets of three beats and counted in four.

Finally, we have an example of 5/4 time at Exercise 21.

EXERCISE 21



This is known as odd metre, because the upper number isn't divisible by two or three. To the majority of Western ears, the feel is alien and can be difficult to work with, but that's merely because so much music is recorded in 4/4. Often, however, the fives in 5/4 tunes are felt as a group of two followed by a group of three, or the other way round. They can be counted like this: ONE two THREE four five *or* ONE two three FOUR five.

The theme to 'Mission Impossible' is recorded in 5/4 time (try humming the theme and counting the number of beats), and Dave Brubeck had a jazz hit with the tune 'Take Five', which, as its name suggests, was also in 5/4. Led Zeppelin's 'The Ocean' moves between 7/8 and 4/4, while other songs proudly boast of their odd metre content within their titles, for instance 'Eleven' by Primus (from *Sailing The Sea Of Cheese*).

Odd metres aren't limited to jazz and film music. Time signatures of 7/4 are found in some of the most memorable pieces of music by the biggest acts – the skill is in making the odd metre feel normal. Pink Floyd's 'Money' and Sting's 'Love Is Stronger Than Justice' are chartbusting hits that use 7/4 timing, even though you may not be aware of it. Peter Gabriel's 'Solsbury Hill' is another example of 7/4. Genesis, Rush, Jethro Tull, Yes, Dream Theater and Nine Inch Nails are just some of the bands that have used odd metre in their songwriting.

At this stage you should be asking yourself some questions when looking at a piece of music such as, "What's the time signature? Is each bar added up correctly? What does that rhythm sound like?" By becoming familiar with the language of music, you will be more comfortable with it. It's not as instantly rewarding as downloading tablature from the internet, but in the long run reading music will probably take you a lot further.

7. THE MAJOR SCALE

The basics

There are very few contemporary pieces of music in which the major scale is played in its entirety from high to low or vice versa as a riff or motif. I found one, when transcribing a Chris Squire bassline from Yes's 'Long Distance Runaround', from *Fragile*. This is surprising, because the major scale is something we are always taught, whichever instrument we choose to take up. The reason is simple; segments of this scale are everywhere in music. Your first steps into practical and theoretical bass playing will always involve some reference to this scale. So let's learn it.

A scale is a specific series of notes played one after the other to give a particular sound. Different scales have different sounds, which musicians exploit to create different moods and feelings in music. Some are happy, some sad, some anxious, some mediaeval or maybe even Egyptian: that's their beauty. A good knowledge of scales will help you capture your feelings.

The major scale is a series of whole tones (steps) and semitones (half steps). A tone is when you move two frets on the bass. A semitone is moving one fret. The formula for a major scale is whole/whole/half/whole/whole/whole/half (in other words, tone/tone/semitone/tone/tone/tone/semitone). The root note is the starting note and the note to which all the others relate. Its importance in harmony is often emphasised by bassists, as in the common request to "just play the root".

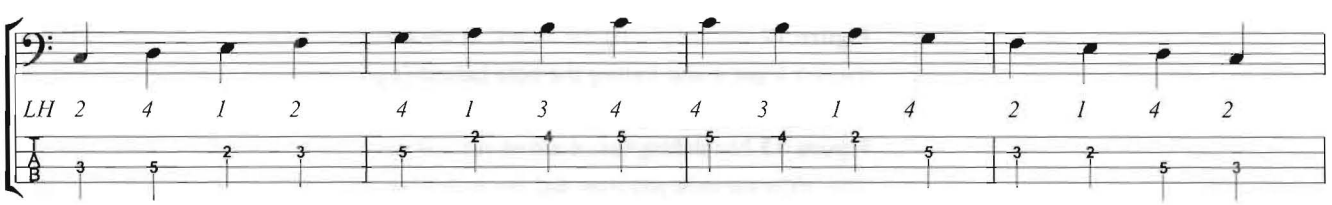
C MAJOR

Using our formula above, constructing a C major scale works like this:
Play C, our root note;
Move a tone up to D;
Move another tone up to E;
Move a semitone to F;
Move a tone to G;
Move a tone to A;
Move a tone to B;
Move a semitone to C, the octave of our root.

Exercise 22 shows the notation, tab and fingering for playing the major scale both ascending and descending.

EXERCISE 22

CD TRACK 11



The sound of this scale may be quite familiar; you might even hear the next note in your head before you play it. Using the lesson on supportive fingering, and playing the root

with the second finger, means every note falls under the fingers without shifting hand position.

Moving a tone takes us to the next letter of our musical alphabet, except at two points, where we only have to move a semitone: between the third and fourth step of the scale (E-F) and the seventh and octave positions (B-C). In C major, all the notes are natural: they contain no sharps or flats.

Luckily for bassists, the resulting pattern can be moved in its entirety and shifted to other root notes. To play a G major scale, simply play the pattern starting at G on the E-string. Repeating the pattern from another root is straightforward, but does limit our knowledge and use of the scale. You should get used to thinking of patterns *and* notes. The following exercises will develop this skill and your ability to move freely around the fingerboard, through position shifting.

Position shifting

Why practise position shifting on the bass? Firstly, few basslines always stay in a position where you don't have to move your hand. There are so many examples that it's almost difficult to choose one, but on this occasion a selection of Red Hot Chili Peppers' tracks comes to mind. Flea rarely hangs around the same place on the bass. Practising shifting on your bass means that when you move out of your main position, you won't feel lost on the fingerboard and unable to return to where you were. I call the area from the fifth fret to the 12th fret the 'no-man's-land' of bass. Many players find it easy to riff about low down on the neck and then shoot up to the 12th fret to play some riff or fill that is often just repetition of the riff lower down. But somehow playing the likes of G♯ and E♭ on the A-string just isn't comfortable.

I'm not saying that the first way of playing, in a fixed position, is wrong – it isn't – but if the reason you are playing this way is because you don't have the confidence to play anything else, then make sure you check out and learn the alternatives so *you* can decide to reject them, and make your own choices when playing. Good, clean, articulate fingerboard shifting is also useful to advanced players, especially in reading, when you want your eyes on the music and not your hand. Walking basslines benefit too. Moving away from your familiar patterns can take you into new melodic areas of the fingerboard.

Using our C major scale we are going to play it all on one string, up and down the neck, with the minimum of shifting required. View this as an advanced exercise. In 20 years of teaching players who could play, but who wanted to move on their careers (as opposed to beginners), I only had two students successfully complete this, even though a good percentage could play the major scale pattern across the strings.

Figure 12 We are playing the note C at the third fret of the A-string, but observe how the first finger is also fretting the note behind (a good example of supportive fingering).

Figure 13 No shifting has occurred yet, and we are playing D, the second note in the scale. Why no shift, you may ask? Because if we use the one finger per fret technique there's no need - the note D can be played by the fourth finger.

Figure 14 This is where your hand will fall after making the first smooth shift and playing

the notes E, F, and G. Having played the note D, your hand moves to the next note in the scale, E, landing on it with the finger that gives the most coverage using a one finger per fret spread. Try it for yourself; if you play the note E with your third finger, you can play F with your fourth, but nothing more without another shift. Playing the E with your first finger allows E, F, and G to be played.

Figure 12
Hold down C on your A-string with your second finger.

Figure 13
Play D at the fifth fret with your fourth finger.

Figure 14
Move your whole hand up the neck and play E at the seventh fret with your first finger.

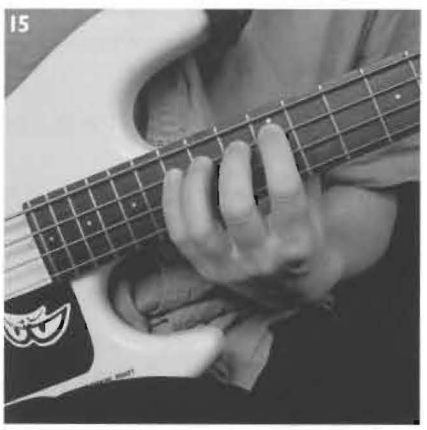


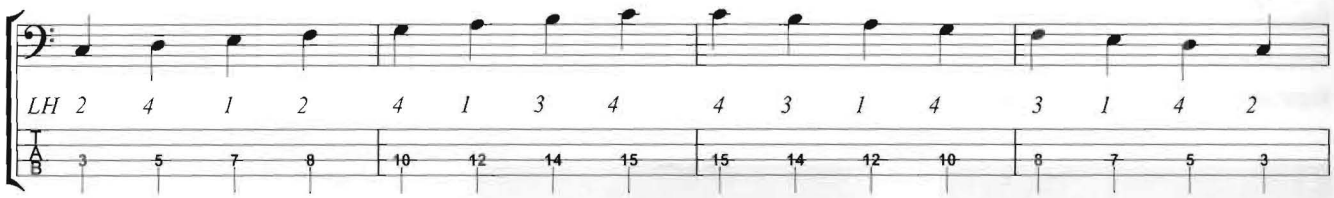
Figure 15
Move up the neck to play A at the 12th fret with your first finger. Now play B and C with your third and fourth fingers.

Try and work out what your second shift will be before studying the final illustration. Remember, we need to play the next notes in sequence: A (at the 12th fret), B, and C.

Figure 15 You should have shifted from your last position to the octave A on your A-string, landing on that note with your first finger. That shift allowed you to play the last three notes in the scale with your first, third, and fourth fingers, providing we maintain the principles of one finger per fret.

You've now completed a one-octave major scale up the same string in two clean shifts. When we shift up the neck, observe that landing on the first finger gives us the greatest reach of notes. When we go back down the scale, that principle is reversed. To reach more notes when descending, we want to be targeting the notes in the scale with our third or fourth fingers. See Exercise 23, where you are shown the fingering to achieve clean shifts both up and back down the neck.

EXERCISE 23



By now your left hand should be moving freely around the fingerboard, utilising good clean position shifts.

Scale drills

By changing the pattern you learnt to help you with your first major scale studies, hopefully you can see how learning the note names as well gives you more freedom as a player. Remember how uncommon it is to find the whole scale performed in music, as opposed to parts of the scale (other than as a study). You may find that our position shifting study locks you into repeating a pattern rather than thinking about notes. In that case, you might want to consider the following exercises, which I've called scale drills. Do all the drills in one scale, then move to another.

DRILL ONE Play from the root of the scale across the strings up to one octave.

DRILL TWO Play from the root of the scale up one string, shifting cleanly up and down.

DRILL THREE Repeat drill one, carrying on to cover two octaves.

DRILL FOUR Still using only the notes in the scale, play from the lowest note in your instrument's range to the highest. Start in one position, without shifting and using only fretted notes; the idea is to try and discover what scale notes lie under your hand. Then do the same across the entire instrument's range, using open strings and shifting where necessary. There are many options for making these shifts: it is up to you.

DRILL FIVE Time to move away from playing the normal scale, one step after another. Now we're going to play different intervals above or below each step on the scale. For instance, we could play intervals of a third above each scale degree. In the key of C that would give this sequence: C E D F E G, etc. Then we could do it again using the interval of a fifth: C G D A E B, and so on.

DRILL SIX Repeat drills one to five in different keys.

DRILL SEVEN Improvise freely.

DRILL EIGHT Relax!

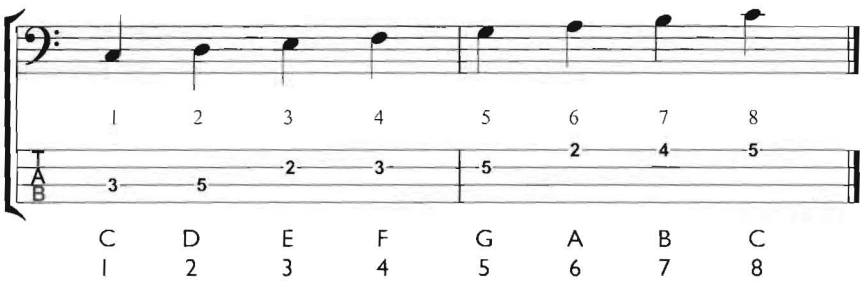
8. INTERVALS

The basics

An interval is the distance in pitch between two notes. Each interval is a combination of quantity and quality. Quantity means the distance between the letter names (or lines and spaces). Quality means the total number of half steps or semitones an interval contains.

Taking the major scale as a reference point, we can work out the distance between the root note and each of its scale steps (or degrees) to determine what are called our diatonic scale intervals. Taking the root as one, we can number each scale degree, as in Exercise 24.

EXERCISE 24



To correctly name an interval, first determine its quantity, meaning the distance in letter names, counting the root note always as 'one':

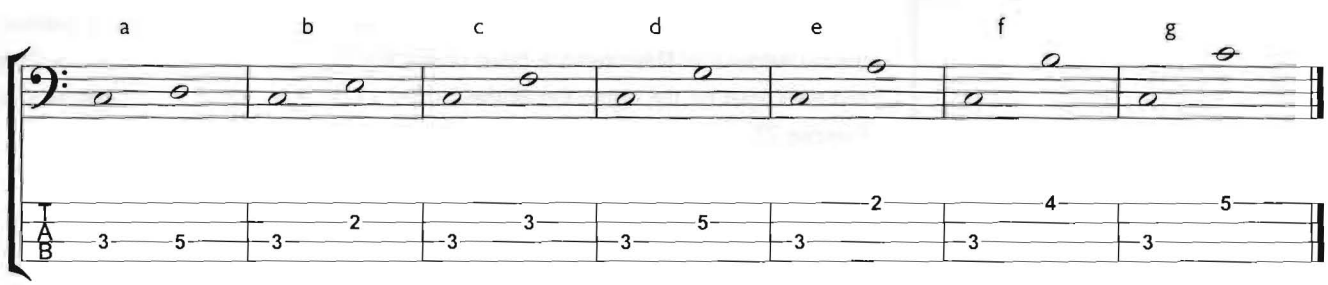
C to D = second
C to E = third
C to F = fourth
C to G = fifth
C to A = sixth
C to B = seventh
C to C = octave

Many of us are familiar with the last interval, the octave. Now it's time to get familiar with the rest.

Each interval has a quality, depending on its exact distance from the root. Intervals that fall within the major scale are named as shown in Exercise 25.

EXERCISE 25

CD TRACK 12



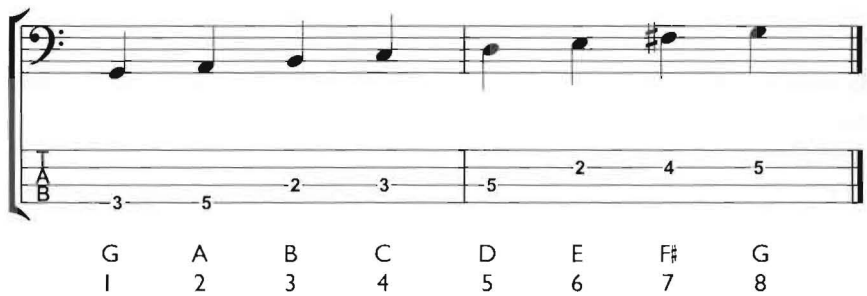
a) C to D = a major second = two frets above the root
b) C to E = a major third = four frets above the root
c) C to F = a perfect fourth = five frets above the root
d) C to G = a perfect fifth = seven frets above the root
e) C to A = a major sixth = nine frets above the root
f) C to B = a major seventh = eleven frets above the root
g) C to C = a perfect octave = twelve frets above the root

You might be thinking, "What's with the perfect intervals? Why aren't they all major? After all, they come from the major scale, not the 'perfect' scale." Essentially it's because the octave, fourth, and fifth have a different quality of sound compared with the others. They are also historically more important in harmony than all the other scale degrees. But don't worry about the history right now; just remember the terms.

Check that you fully understand these concepts by taking another scale and working out the intervals within it. For example, what is the perfect fourth of G? Exercise 26 shows you how to do it.

Work out the scale:

EXERCISE 26



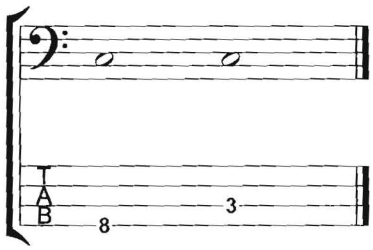
Move up four scale degrees from the root, and that's your answer: C.

What interval is F♯? Move up the scale to F♯, seven scale degrees from the root, to get your answer: a major seventh.

Intervals can be played on the bass either as chords (both notes sounded together) or as melodic intervals (each note played separately). Stanley Clarke's 'School Days' uses perfect fifth chord shapes in its catchy intro. U2's Adam Clayton uses major and minor thirds played melodically on his driving bass part to 'New Years Day'. There are thousands of examples in music.

Note: if you take your starting note, in this case C, and then play another C on your instrument at the same pitch, you also get an interval, even though the distance between the two notes is nil. This interval is called unison. Playing C at the third fret on the A-string and then again on the eighth fret of the E-string would give us the unison interval, as at Exercise 27.

EXERCISE 27



Chromatic intervals

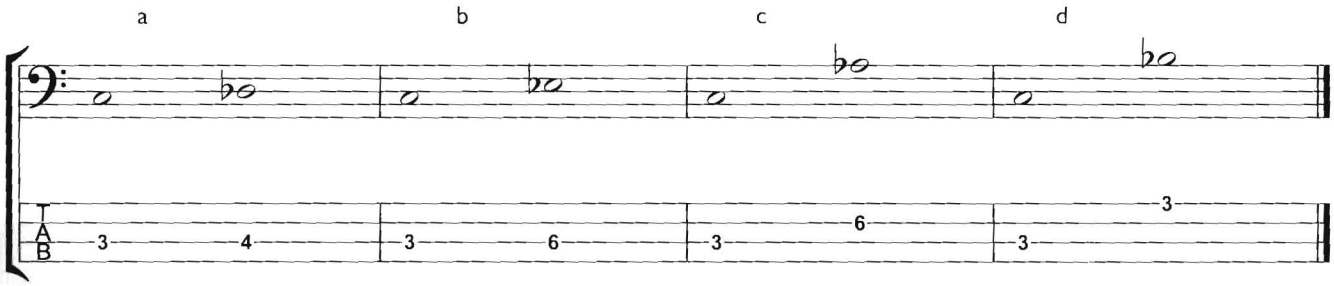
Chromatic or non-diatonic intervals are intervals that don't occur naturally with respect to the root in a major or minor scale. If we flatten or sharpen any of the intervals that do occur in the scale we create new chromatic intervals and new sounds. Remember that to alter the interval you only alter the note above the root, not both notes. There are some basic rules that will need to be learnt to correctly name these chromatic intervals.

RULE ONE

If a major interval is lowered by a half step or semitone it becomes minor.

EXERCISE 28

CD TRACK 13



For example:

a) If we flatten the second of C, which is D, by a fret, it becomes D♭. It has now changed from a major second to a minor second.

b) If we flatten the third of C, which is E, by a fret, it becomes E♭. It has now changed from a major third to a minor third.

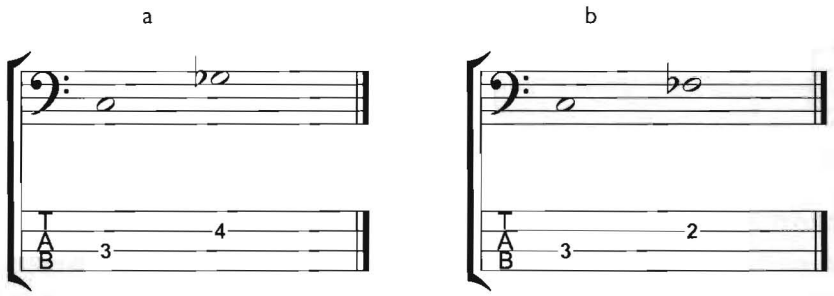
c) If we flatten the sixth of C, which is A, by a fret, it becomes A♭. It has now changed from a major sixth to a minor sixth.

d) If we flatten the seventh of C, which is B, by a fret, it becomes B♭. It has now changed from a major seventh to a minor seventh.

RULE TWO

If a perfect interval is lowered by a half step or semitone it becomes diminished.

EXERCISE 29



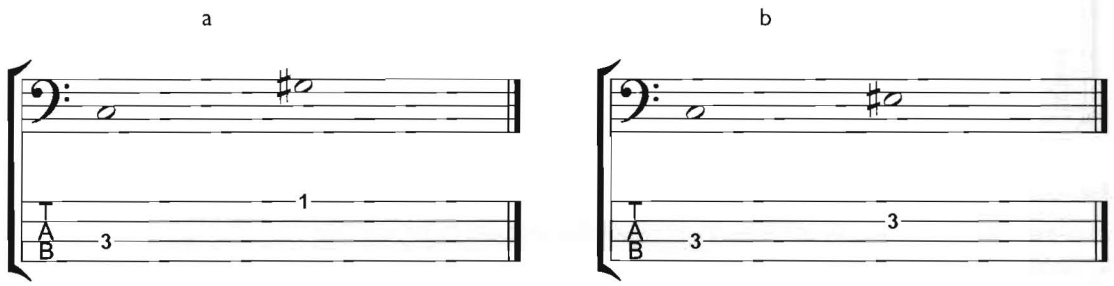
a) If we flatten the fifth of C, which is G, by a fret, it becomes G♭. It has now changed from a perfect fifth to a diminished fifth.

b) If we flatten the fourth of C, which is F, by a fret, it becomes F♭. It has now changed from a perfect fourth to a diminished fourth. Note that F♭ has the same sound as E, but it has to be called F♭ because the rules for naming intervals require a fourth to be four letter names from the root, counting the root as 'one'. Notes that have the same sound but different names are called enharmonic. So, for example, the enharmonic equivalent of E♭ is D♯. The enharmonic equivalent of C♭ is B.

RULE THREE

If a perfect or major interval is raised by a half step or semitone it becomes augmented.

EXERCISE 30



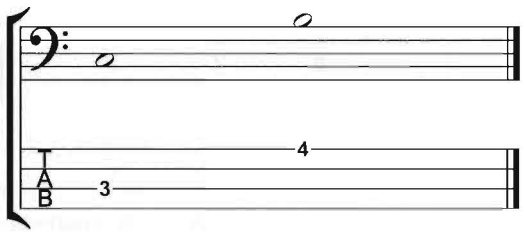
a) If we sharpen the fifth of C, which is G, by a fret, it becomes G♯. It has now changed from a perfect fifth to an augmented fifth.

b) If we sharpen the third of C which is E by a fret it becomes E♯. It has now changed from a major third to an augmented third. E♯ is another enharmonic note, the equivalent of F.

RULE FOUR

If a minor interval is raised by a half step or semitone it becomes major.

EXERCISE 31

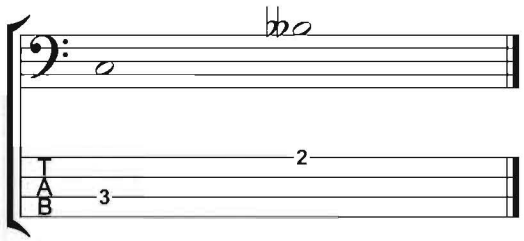


If we raise the minor seventh of C, which is B♭, by a fret, it becomes B. It has now changed from a minor seventh to a major seventh.

RULE FIVE

If a minor interval is lowered by a half step or semitone it becomes diminished.

EXERCISE 32



If we flatten the minor seventh of C, which is B♭, by a fret it becomes B𝄫, called 'B double flat'. It has now changed from a minor seventh to a diminished seventh.

In order to maintain the correct notation of the interval we must call it B𝄫 and not A, although it sounds the same. This is another enharmonic note, as we saw in Exercises 29 and 30.

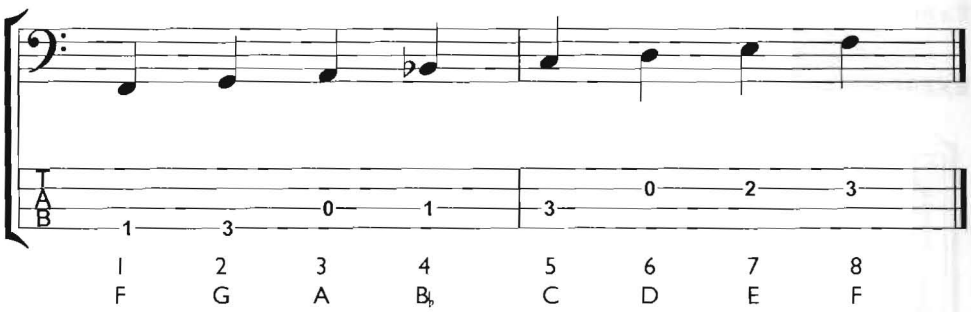
As well as *double flats* you will also come across *double sharps*. This is the symbol for a double sharp: 𝄪

In these cases, instead of flattening or sharpening a note by one fret we flatten or sharpen it by two frets. This is fairly rare, but when it occurs it is important you understand it.

The reason for all these rules and principles is to see these intervals and apply them on your instrument. But you also need to be able to read them from the stave and label them correctly.

Let's have a look at how these rules work in practice. The following exercises will help you understand both diatonic and non-diatonic intervals. The first example is in the key of F major.

EXERCISE 33



From the F major scale above, the following non-diatonic intervals can be created by making these alterations:

Minor seventh = E to E♭
Augmented fourth = B♭ to B
Minor third = A to A♭
Minor second = G to G♭
Diminished fifth = C to C♭
Minor sixth = D to D♭
Augmented fifth = C to C♯

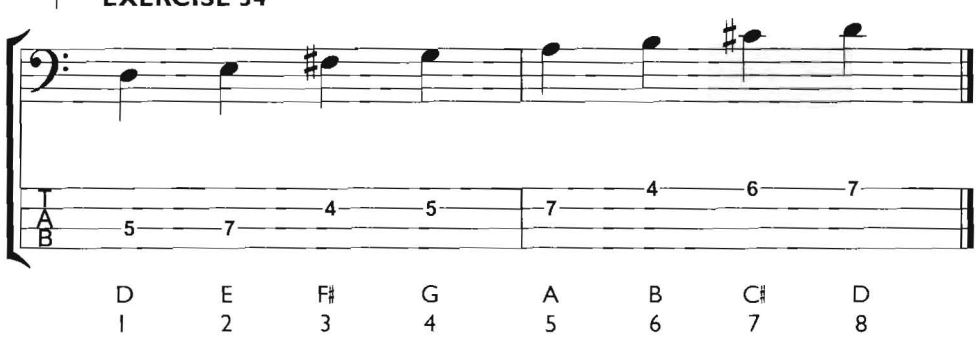
Here are some non-diatonic intervals that can be created from the G major scale.

1	2	3	4	5	6	7	8
G	A	B	C	D	E	F♯	G

Minor sixth = E to E♭
Minor seventh = F♯ to F
Minor third = B to B♭
Diminished fifth = D to D♭
Minor second = A to A♭
Diminished seventh = F♯ to F♭
Augmented fifth = D to D♯
Augmented fourth = C to C♯

Conversely, you should be able to name the intervals if you are given any note above the root. Here the scale is D major. (Examples of both diatonic and non-diatonic intervals are included.)

EXERCISE 34

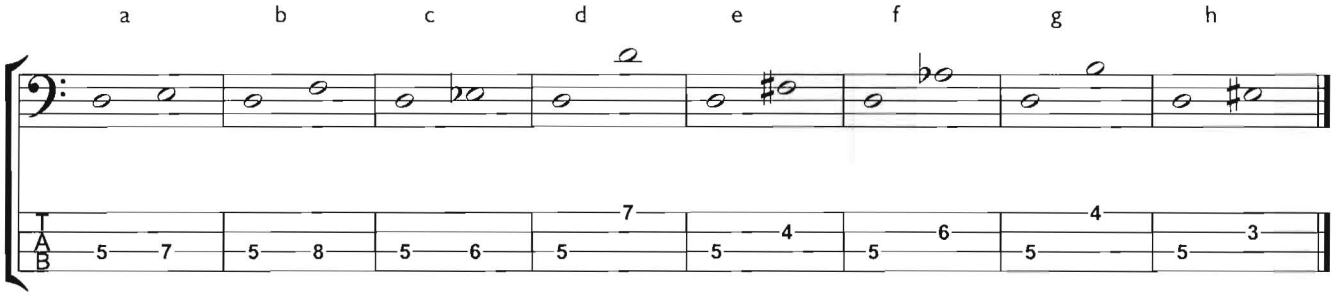


E♭ = minor second
E = major second
F = minor third
F♯ = major third
G = perfect fourth
G♯ = augmented fourth
A♭ = diminished fifth
A = perfect fifth
A♯ = augmented fifth
B♭ = minor sixth
B = major sixth
C = minor seventh
C♯ = major seventh

Note: G♯ and A♭, and A♯ and B♭, are enharmonic equivalents.

In this exercise you should be able to name the intervals by seeing them in the notation. They are all above a D root.

EXERCISE 35



a) major second
b) minor third
c) minor second
d) octave
e) major third
f) diminished fifth
g) major sixth
h) augmented second

9. TRIADS

Triads are chords containing three notes comprising a root, a third and a fifth. As bass players we rarely play triads as chords (unlike our guitar playing cousins); instead we usually play them melodically, like our melodic intervals, one note at a time. There are no rules about this, of course. It's just that chords played on the bass in the lower registers sound muddy or indistinct and can interfere with guitars/keyboards/horn sections, etc. When we play chords on the bass, there are ways of achieving clarity and note definition (see Bass Chords, p233) but for now it's all about creating riffs, patterns and lines from the chords that other band members are playing in the song.

There are four main families of triad: major, minor, augmented, and diminished.

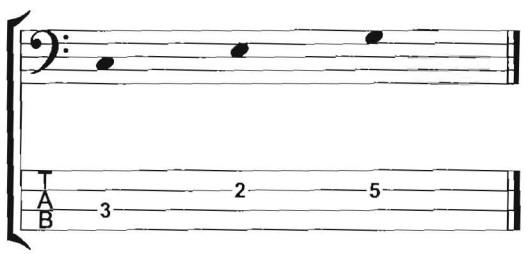
The major triad

The major scale comes into play yet again. Simply take the first, third, and fifth degrees of the scale and you create a major triad. For example, using a C major scale to form a C major triad gives us the following notes: C (root), E (major third), and G (perfect fifth). Our formula is: root/major third/fifth.

CD TRACK 14

EXERCISE 36

Major triad = R + maj3 + 5



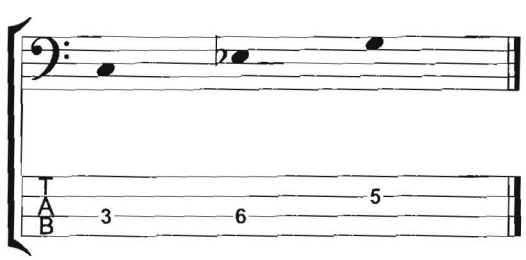
The minor triad

To create a minor triad, take the major triad and lower (flatten) the third. A C minor triad therefore comprises C (root), E♭ (minor third), and G (perfect fifth). The formula is: root/minor third/fifth.

CD TRACK 14

EXERCISE 37

Minor triad = R + ♭3 + 5



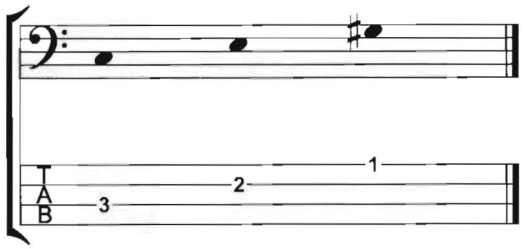
The augmented triad

To create an augmented triad, take the major triad and raise (sharpen) the fifth. A C augmented triad therefore comprises C (root), E (major third), and G♯ (augmented fifth). The formula is: root/major third/augmented fifth.

CD TRACK 14

EXERCISE 38

Augmented triad = R + maj3 + aug5



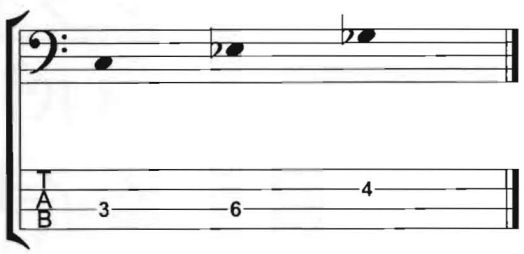
The diminished triad

To create a diminished triad, take the minor triad and lower (flatten) the fifth. A C diminished triad therefore comprises C (root), E♭ (minor third), and G♭ (diminished fifth). The formula is: root/minor third/diminished fifth.

CD TRACK 14

EXERCISE 39

Diminished triad = R + ♭3 + ♭5



Chord symbols

Shorthand symbols are often used to describe the type of chord being played.

Major	maj	Δ	MA	M
Minor	min	-	MI	m
Augmented	aug	+		
Diminished	dim	°		

You will notice that each triad, no matter what its formula or name, is always made up of a stack of thirds, one above the other. So, in our C major triad, E is a major third above C, and G is a minor third above E.

Triads appear frequently in basslines. Most traditional blues is worked around triads.

Check out Noel Redding's bass work in 'Manic Depression' (descending major triads) or Paul McCartney's intro to 'Lovely Rita' (descending inverted triads). And have a listen to Mark King's 'Lessons in Love', a slapped riff over a G major/B major/E minor/C major progression. These are just a few of many possibilities. You'll be seeing how these work in Blues Performance 1.

10. BLUES PERFORMANCE 1

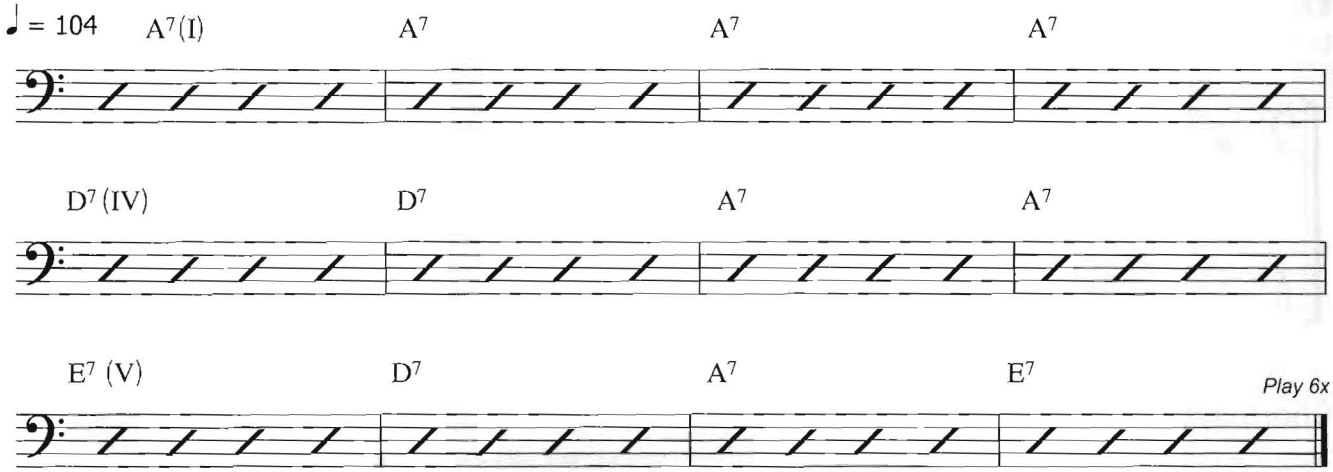
Let's play some music! Love or loathe it, the blues chord progression and style forms the backbone to a great deal of music. Originating from the pained but soulful chants of African slaves many centuries ago, and then evolving slowly into an electrified style through the works of famed bluesmen such as Robert Johnson, the blues encompasses an emotional and spiritual feeling ("I've got the blues today ..."). Today, the blues uses various chord progressions but there is an accepted foundation. I'll leave the emotion and feelings to you; let's look at one of the most popular blues progressions, the 12-bar blues.

The chart

Exercise 40 is our 12-bar blues chart. As its name suggests, there are 12 bars of music, repeated as many times as the bandleader desires. Here the chart tells us to play it six times. The track appears first on the CD without bass.

CD TRACK 15

EXERCISE 40



Looking back at its origins, the blues structure evolved to support a call and answer type of phrasing sung by the slaves. Our chart is in the key of A. The first four bars are based upon the A7 chord. You'll also see a roman numeral I next to it in brackets. This indicates that it is the chord built on the first degree of the scale (see Major Scale Harmony, p187). Chord progressions use these roman numeral labels so that they can easily be transposed to different keys without each individual chord having to be named.

In this piece the I chord is a seventh chord, shown by the 7 after its letter-name. Before we look at seventh chords, you need to know that this chord has the major triad as its foundation. The next two bars are based upon the D7 chord, which has the D major

triad as its foundation. As the fourth degree up from A, it has a roman IV next to it. Then we return for two bars to A7. At bar nine we move to the V chord, five scale degrees from our first chord: in this case it is E7. This chord is based on an E major triad. Bar 10 returns us to D7, bar 11 to A7 and bar 12 (also referred to as the turnaround bar) back to the V7 chord: E7. Note that we only have three chords to deal with: A7, D7, and E7. The basis of the chord is the same in each case – a major triad.

The time signature is 4/4. The tempo is marked at quarter-note = 104. The repeat marks at the end of the chart tell us to repeat the sequence. In this case, an extra instruction tells us to play it six times through.

There is no bassline written out (initially). We need to come up with a line from our knowledge and experience.

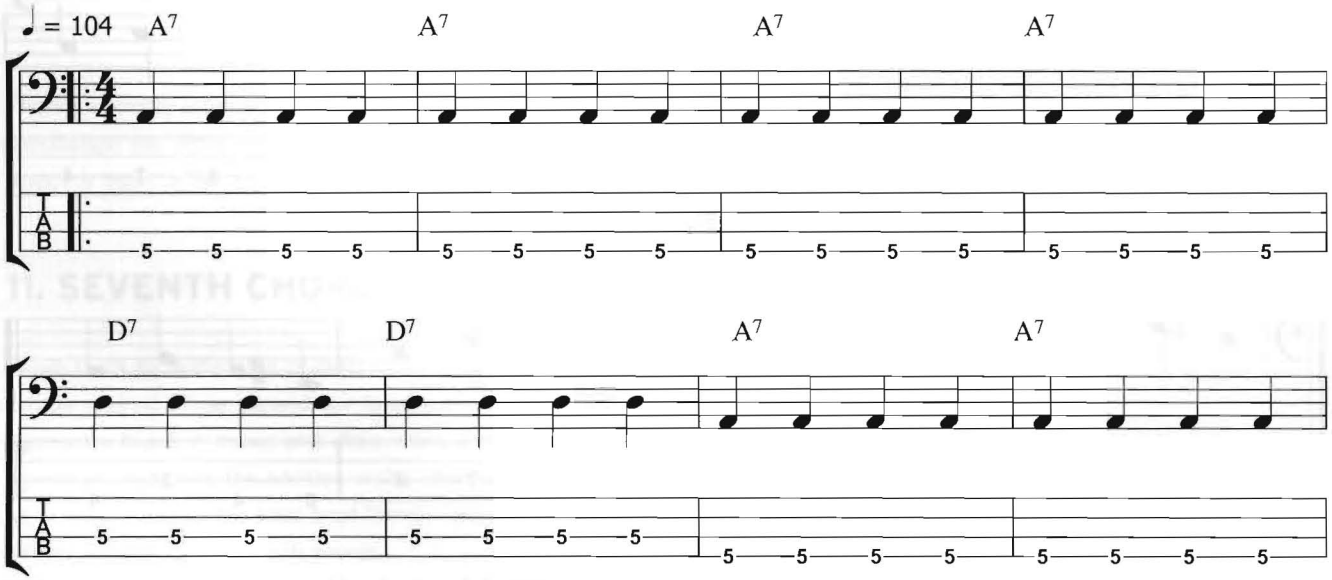
To create the right sense of finality, we need to end the tune on the I7 chord we began with, but the chart ends on the V7. Strictly speaking we would need to add a coda or ending to the chart. But most blues numbers are played without a chart, and in those cases the ending is implied and improvised rather than being written out.

Creating a bassline

The chart is played through six times with a four beat intro (not shown, because the chart is stripped to its most basic form). Our first line is simplicity itself; play the root note to each chord. The pattern is shown at Exercise 41. The root note changes when each new chord appears in the chart. The difficulty is doing this with solid timing, good tone, and feel. It's not as easy as it sounds. This sequence is played twice on the CD.

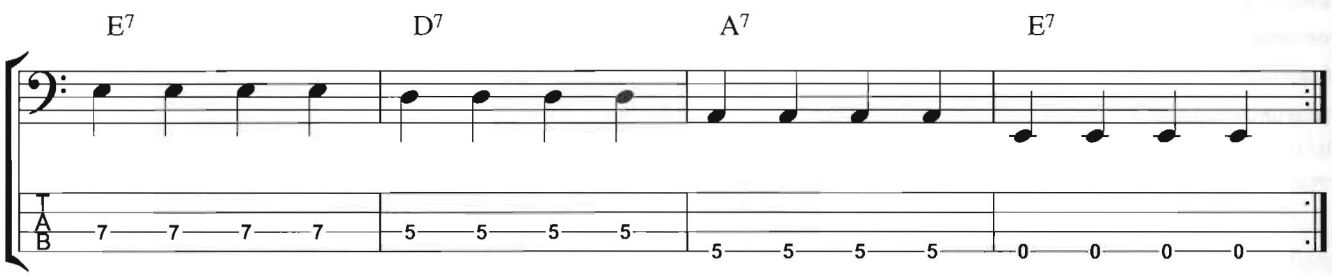
EXERCISE 41

CD TRACK **16**



continued over page

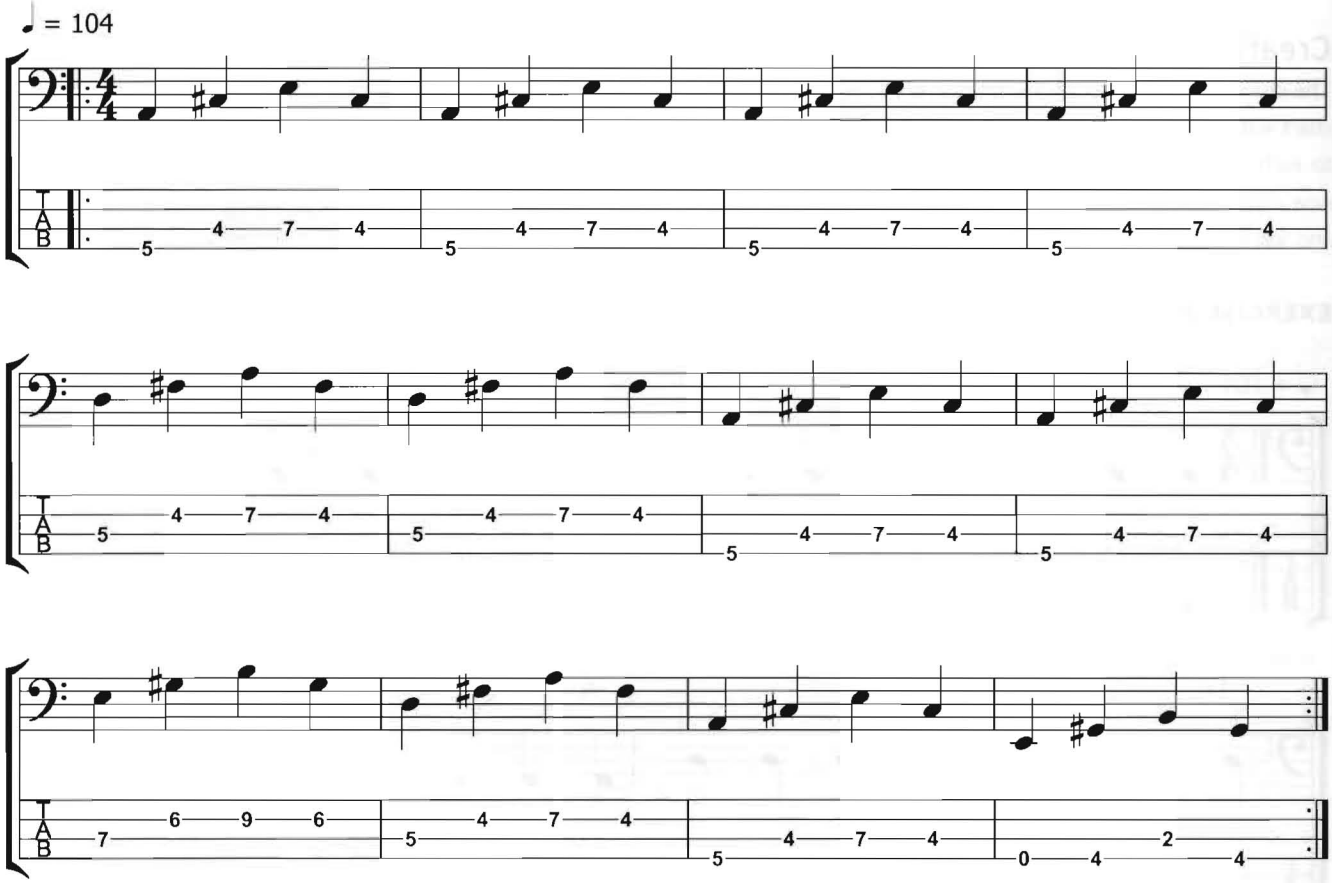
Exercise 41 *continued*



Our second bassline (Exercise 42) plays triads in a root-third-fifth-third pattern to give four beats per bar. The E chord shape at bar nine could also be played in an open position – try it for a variation and to start thinking about notes rather than just shapes. This is played twice on the CD.

CD TRACK **16**

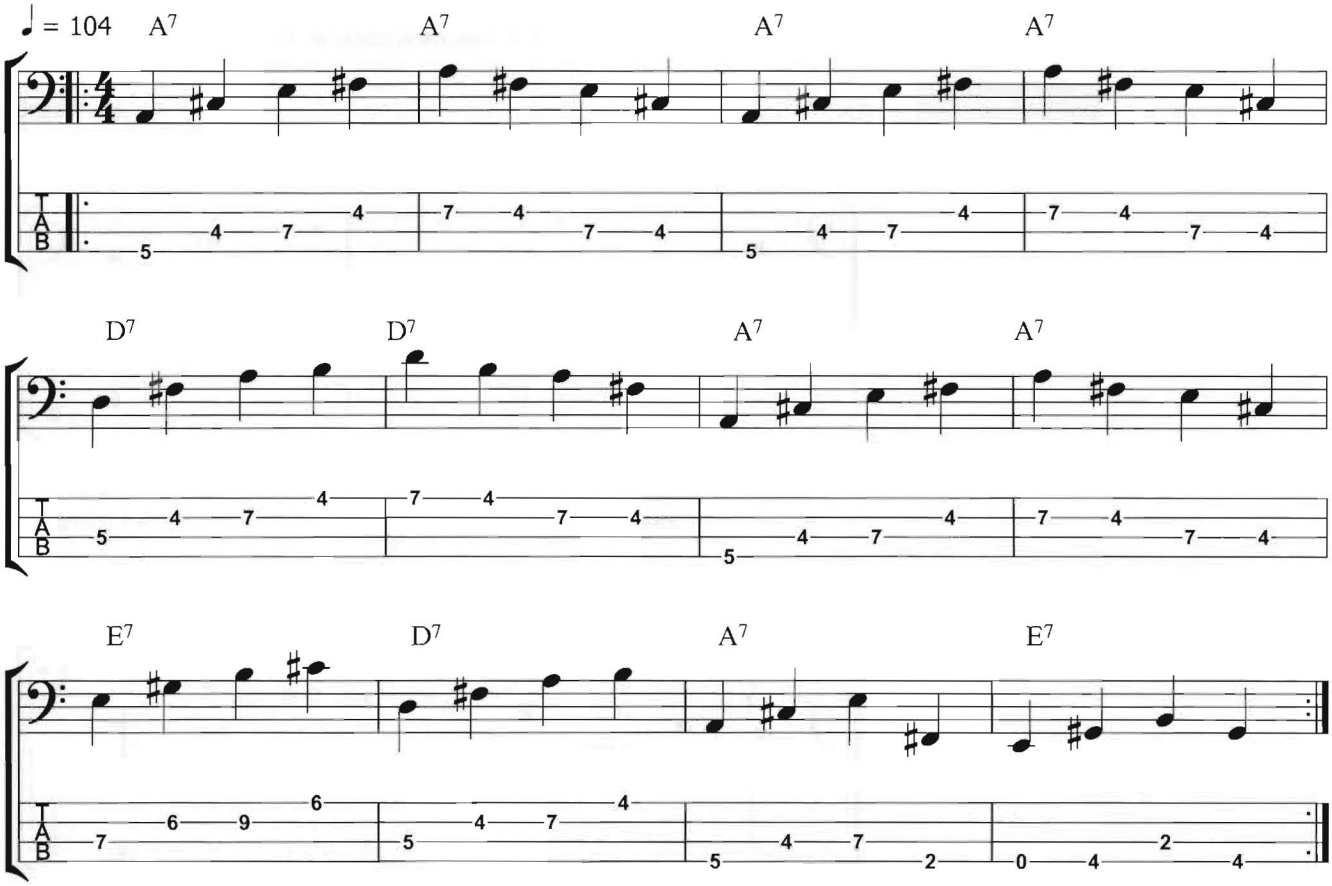
EXERCISE 42



Our third bassline (Exercise 43) embellishes the triad by adding the sixth degree of the major scale to each chord. This is a very common blues sound and moves through the following pattern when the same chord remains over two complete bars; root-third-fifth-sixth, octave-sixth-fifth-third. For one bar examples, just go up through the root-third-fifth-sixth pattern. This line is written out in full with the chords above each bar.

EXERCISE 43

CD TRACK 16



The line normally ascends and descends in the pattern described, but the last note in the penultimate bar drops to the F♯ below the root for added interest, and to link more smoothly into the low E.

11. SEVENTH CHORDS

While triads form the basis of most of the chords we play, more complex chord forms can be created. These expand our tonal palette, allow a deeper understanding of the harmonies found in music, and allow more creative basslines. Seventh chords can be viewed as triads with the addition of the interval of a seventh, so it's essential you have an understanding of the basic triad forms – major, minor, diminished, and augmented – before progressing to seventh chords.

The major seventh chord

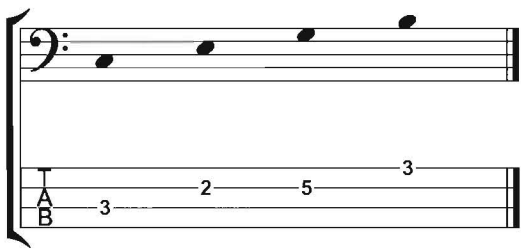
The formula for a major seventh chord is root/major third/perfect fifth/major seventh.

Using our simplest major scale, C major, the notes in a Cmaj7 chord are C E G B.

CD TRACK 17

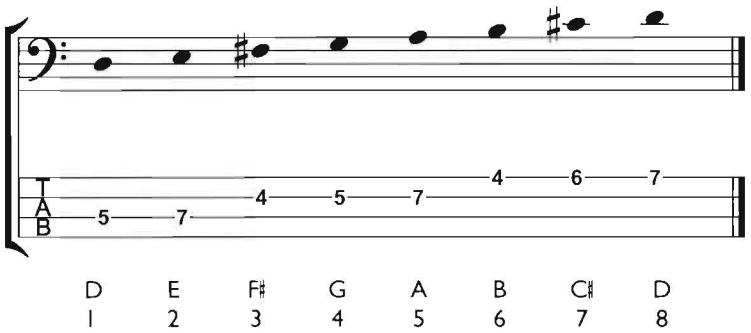
EXERCISE 44

Major seventh = R + maj3 + 5 + maj7



Check your understanding of this concept by building a D major seventh chord. Start with the D major scale.

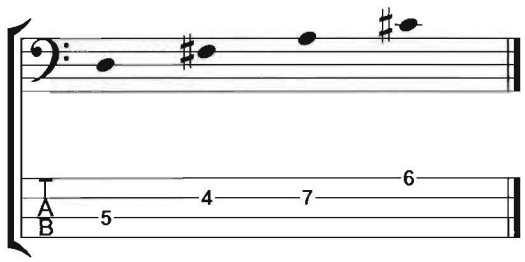
EXERCISE 45



D	E	F♯	G	A	B	C♯	D
1	2	3	4	5	6	7	8

Use the formula: root/major third/perfect fifth/major seventh (R + maj3 + 5 + maj7). The result? D F♯ A C♯.

EXERCISE 46



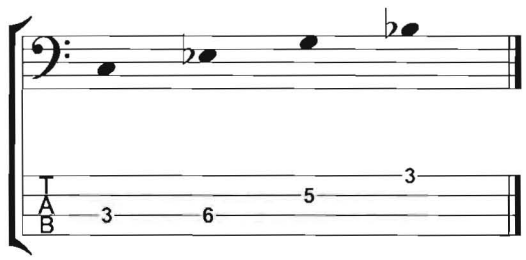
The minor seventh chord

Our formula for a minor seventh chord is root/minor third/perfect fifth/minor seventh. So the notes in a Cm7 chord are C E♭ G B♭.

CD TRACK 18

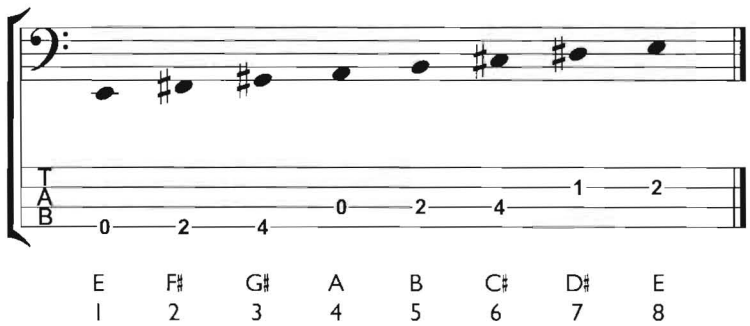
EXERCISE 47

Minor seventh = R + ♭3 + 5 + ♭7



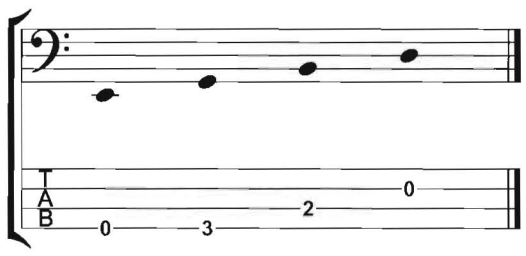
To build an E minor seventh chord, you start with the E major scale.

EXERCISE 48



Use the formula R + ♭3 + 5 + ♭7, altering the notes from the major scale as necessary. The result? E G B D.

EXERCISE 49



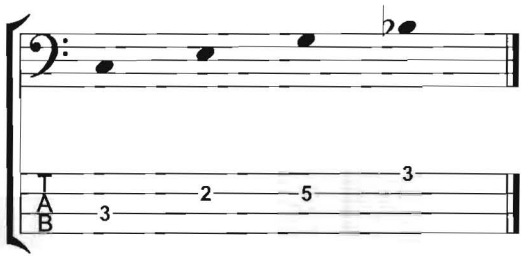
The dominant seventh chord

Our formula for a dominant seventh chord is root/major third/perfect fifth/minor seventh. So the notes in a C7 chord are C E G B♭.

CD TRACK 19

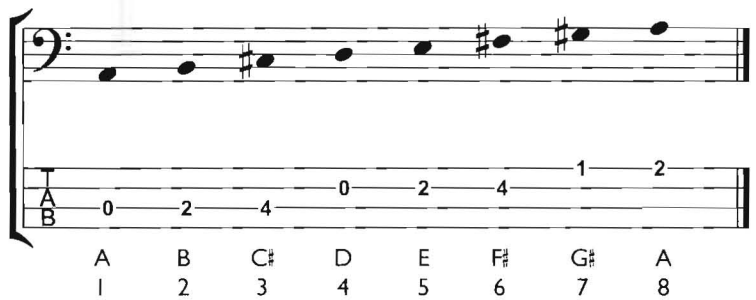
EXERCISE 50

Dominant seventh = R + maj3 + 5 + ♭7



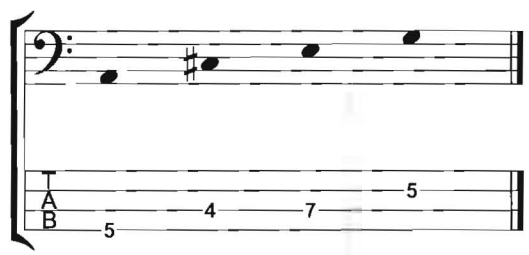
Check your understanding of this concept by building an A7 chord.
Start with the A major scale.

EXERCISE 51



Use the formula: R + maj3 + 5 + ♭7. The result? A C♯ E G.

EXERCISE 52



The dominant chord family is the largest of the chord families, with an enormous array of sounds and colours (see Chord Extensions, p230). So although the chords are built on a major triad, they occupy a family of their own. Dominant chords are often used to lead us back to the start of a piece of music, although some music forms have embraced the dominant chord sound and used it in their own unique way, for instance blues and funk. How a chord is used is described as its function.

These four seventh chords, like the four basic triads, will cover the needs of many bassists, but by no means give us the complete picture. Our next section covers more seventh chords, essential for players working on their jazz or compositional abilities.

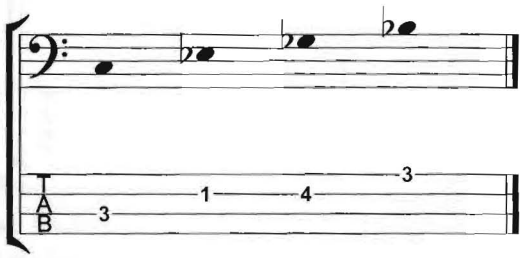
The half-diminished chord

The formula for a half-diminished or minor seventh flattened fifth chord is root/minor third/diminished fifth/minor seventh. Using the C major scale as our reference point again, the notes in a Cm7(♭5) chord are C E♭ G♭ B♭:

CD TRACK 20

EXERCISE 53

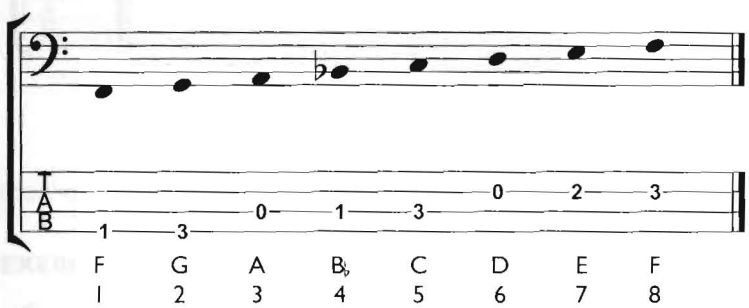
Half-diminished or minor seventh flattened fifth = R + ♭3 + ♭5 + ♭7



These chords often function as substitutes for minor or minor seventh chords, but they have other, more complex uses as well. Just make sure you understand their construction for now.

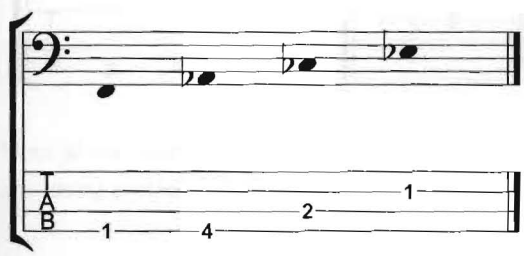
Build an Fm7(♭5) chord using the F major scale below.

EXERCISE 54



Use the formula R + ♭3 + ♭5 + ♭7. The result? F A♭ C♭ E♭.

EXERCISE 55



CHORD SPELLING

The diminished, augmented, and half-diminished chords illustrate the correct use of the enharmonic principle we looked at in our interval section. To create the F half-diminished chord, we need to take the normal fifth, C, and flatten it by a semitone to produced the diminished fifth interval. On the face of it, that would give us the note B, making the notes in the chord F - A♭ - B - E♭. But chords are usually built in thirds, and the interval from A♭ to B is only a second. To make it a third, we have to change the name of B to C♭, which is enharmonic, meaning it has the same sound. The chord is correctly 'spelt' F-A♭-C♭-E♭. The same principle is at work in the A augmented (containing E♯) and G diminished (containing F♭) chords on this page. Now this may be no big deal in performing terms, in terms of becoming the next greatest bass player, or by many other criteria. But why not discuss music in the correct way? It shows you are serious about your studies, could pay dividends on a session, and is no harder to grasp than doing it the wrong way.

The augmented seventh chord

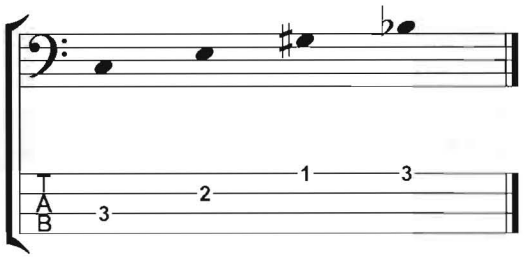
Our formula for an augmented seventh chord is root/major third/augmented fifth/minor seventh.

Using the C major scale as our reference point again, the notes in a Caug7 chord are C E G♯ B♭.

CD TRACK 21

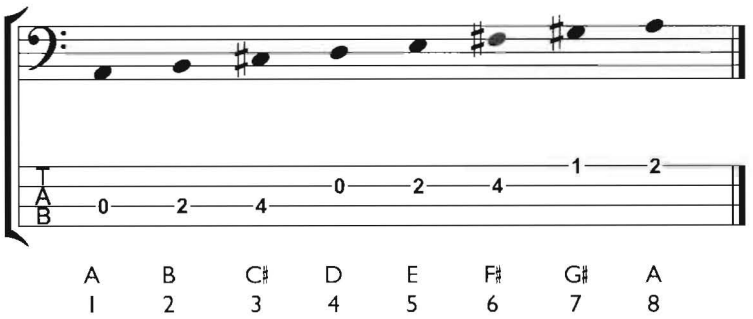
EXERCISE 56

Augmented seventh = R + maj3 + aug5 + ♭7



Build an augmented chord on a different root to C to show that you understand the chord-building process. Start with the parent major scale.

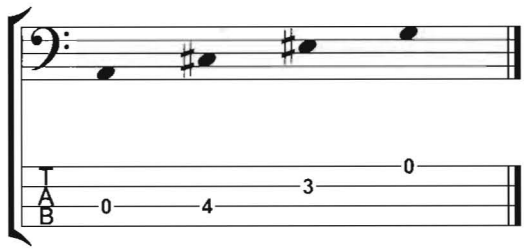
EXERCISE 57



A	B	C♯	D	E	F♯	G♯	A
1	2	3	4	5	6	7	8

Use the formula R + maj3 + aug5 + ♭7. The result? A C♯ E♯ G.

EXERCISE 58



The diminished seventh chord

Our formula for a diminished seventh chord is root/minor third/diminished fifth/diminished seventh. It can be referred to as the fully diminished chord to distinguish it from the half-diminished chord.

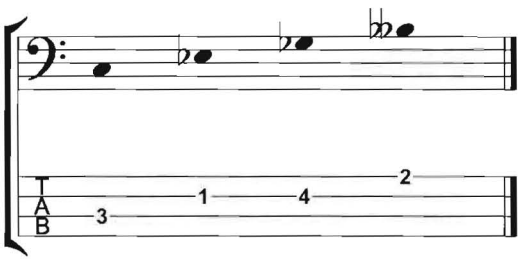
The notes in a Cdim7 (C°7) chord are

C E♭, G♭, B𝄫.

CD TRACK **22**

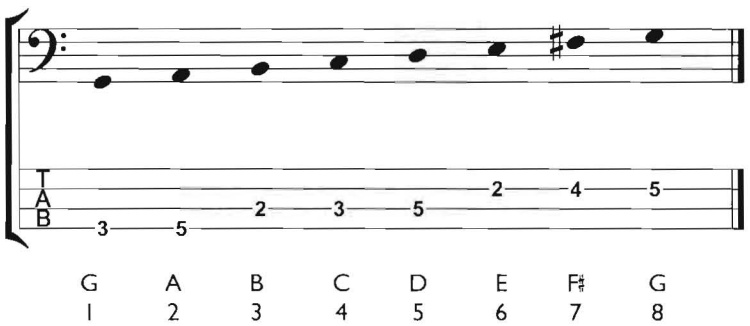
EXERCISE 59

Diminished seventh = R + ♭3 + ♭5 + dim7



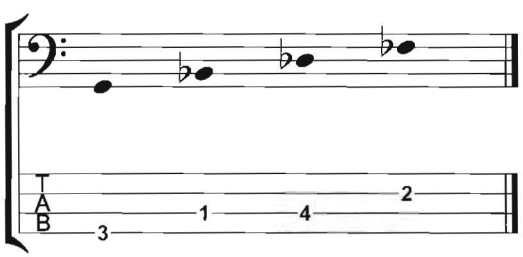
Let's build a G diminished chord. Start with the parent major scale.

EXERCISE 60



Use the formula R + ♭3 + ♭5 + dim7. The result? G B♭, D♭, F♭.

EXERCISE 61



Note: all our seventh chords still use triads as their basic building blocks. In each case we are adding another third interval on top of the last note of the triad, the fifth.

IMPROVISING TIP

The diminished chord is a useful improvisational tool when used a semitone up from a dominant chord. For example, use Fdim7 instead of E7 .

Seventh chord symbols

Various shorthand symbols are used to describe seventh chords

Major seventh	maj7	Δ7			MA7
Minor seventh	min7	-7		m7	MI7
Dominant seventh		7			
Augmented seventh	aug7	+7	7(♯5)		
Diminished seventh	dim7	°7			
Half-diminished seventh	min7(♭5)	∅	-7(♭5)	m7(♭5)	

An understanding of seventh chords will give you the chance to play almost any style of music, by listening to and analysing the chords that are present and then creating basslines from those chord structures.

Literally thousands of basslines are made from a combination of chord tones (the root, third, fifth, and seventh of each chord) and a catchy rhythm. Sometimes the riff is based entirely on the notes from the seventh chord.

Note that in each case the bassist doesn't necessarily use all the chord tones and will sometimes add a scale tone. But the essence of the line is that the chord tones derived from the chord are being played or implied.

Diagrams 4 to 9 show suggested fingerings where major-based seventh chord tones are played from the root on the second finger, and minor-based chord tones are played from the root on the first finger. Note that sometimes you can comfortably play the chord tones without shifting from a one finger per fret method; but at other times a deliberate shift or stretch is required.

Seventh chord fingerings

Diagram 4
C major seventh

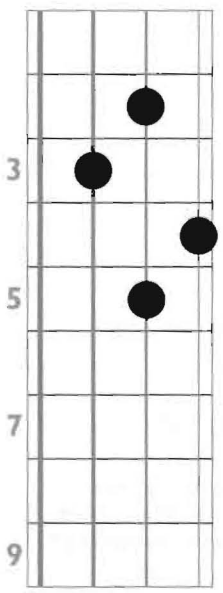


Diagram 5
C minor seventh

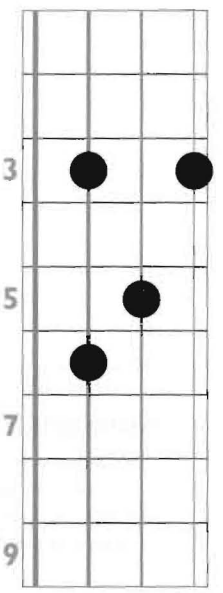


Diagram 6
C dominant seventh

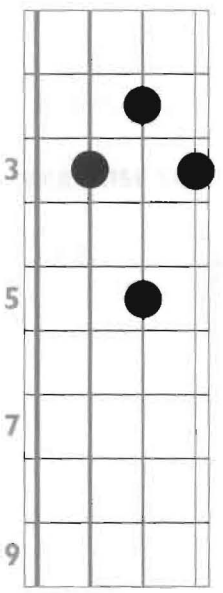


Diagram 7
C minor seven (flattened fifth)

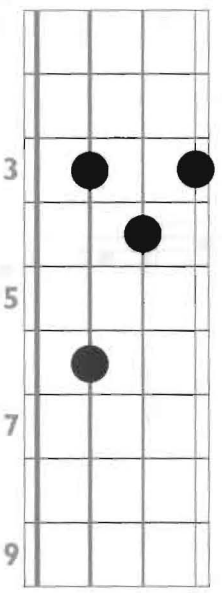


Diagram 8
C augmented seventh

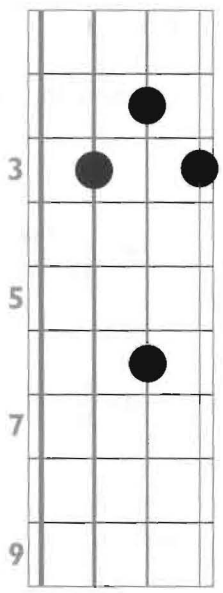
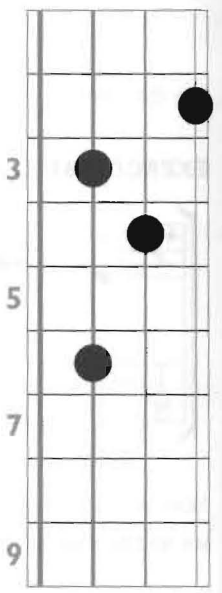


Diagram 9
C diminished seventh



Alternative seventh chord fingerings

Diagrams 10 to 15 show alternative fingerings, using fourth and third fingers on the root. Learn as many fingerings as possible, by understanding the theory and knowing where to find the notes on the bass.

Diagram 10
C major seventh

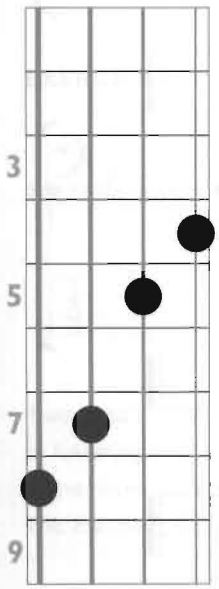


Diagram 11
C minor seventh

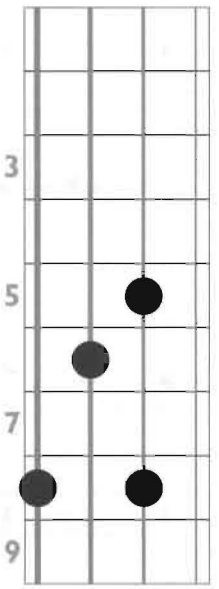


Diagram 12
C dominant seventh

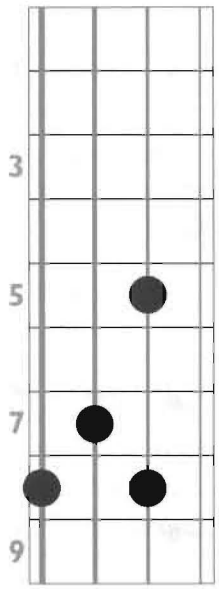


Diagram 13
C minor seventh (flattened fifth)

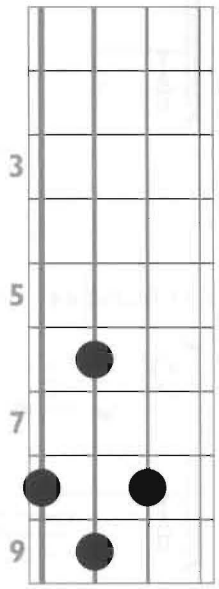


Diagram 14
C augmented seventh

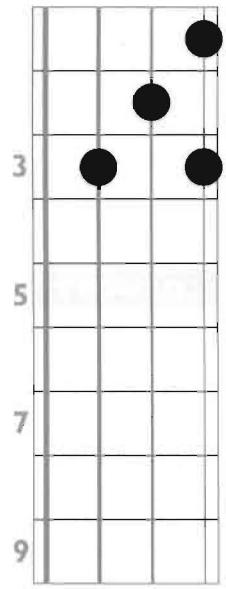
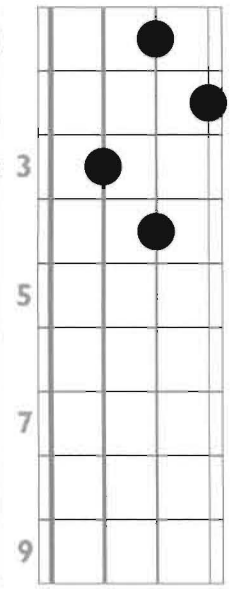


Diagram 15
C diminished seventh

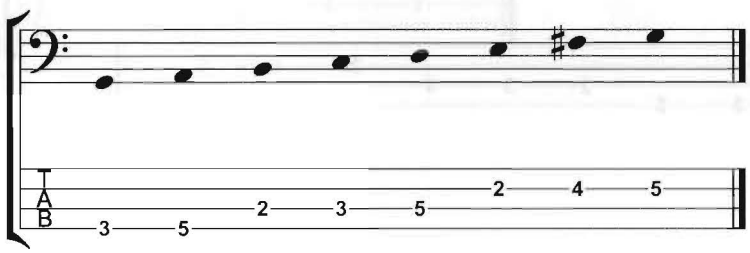


12. KEY SIGNATURES

We've discovered that playing a C major scale, using the major scale step formula of whole-whole-half-whole-whole-whole-half gives us a major scale with no sharps or flats. And the resulting pattern can be applied to any given root note to produce a major scale with a new tonic, that being the fundamental note to which all the others relate and which gives the scale its name. This is called transposing the scale. To play a major scale from G, using our pattern of whole and half-notes, we need to alter one of the notes from the C major exercise to make it fit the formula. That note is F, which must be raised a semitone to F♯.

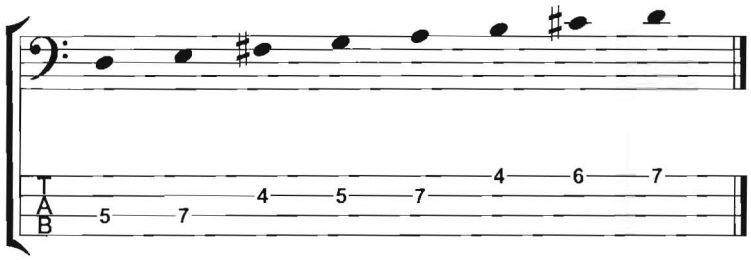
Our G major scale therefore comprises the notes G A B C D E F♯ G.

EXERCISE 62



Now repeat this exercise for a scale starting on the note D. You'll see that now we have to alter two notes to fit the formula: F and C, which become F♯ and C♯.

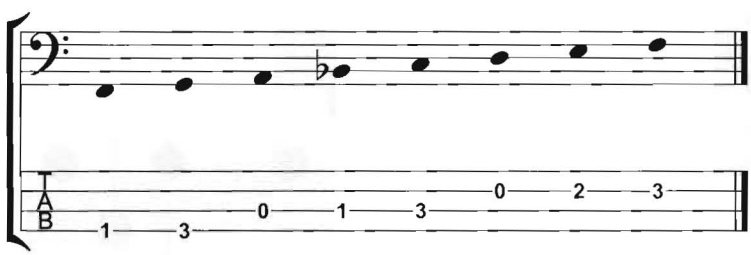
EXERCISE 63



Using the root note of F requires another alteration, only this time we need to lower one of the notes, from B to B♭.

CD TRACK **23**

EXERCISE 64

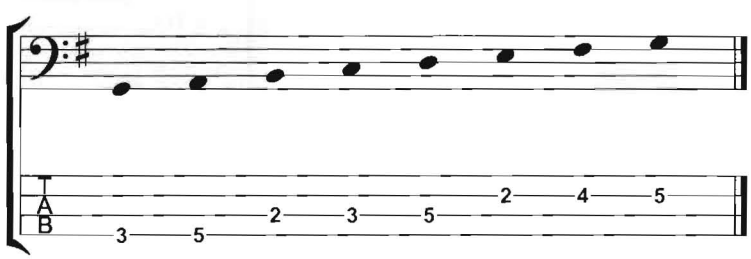


And starting a new major scale from B♭ would require B♭ and E♭ to be used. If we wrote a piece of music using any of these scales, we would need to write in these sharps or flats every single time they appeared. To avoid that we use a key signature.

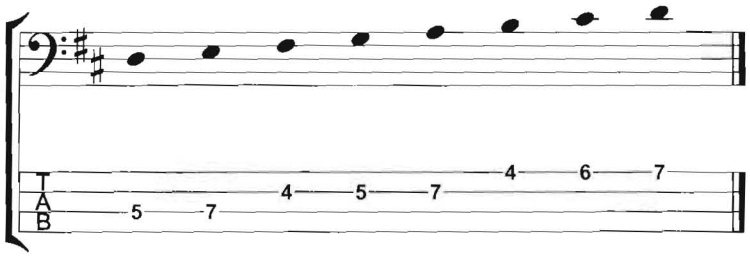
A key signature appears at the start of a piece of music and at the start of each line thereafter. Keys can change at any point in the music and then a new key signature is shown after a double bar line.

The three scales above are shown with key signatures at Exercises 65, 66, and 67. Note that the sharp or flat isn't randomly placed on the stave – it is located exactly on the note line or space that will be altered throughout the piece.

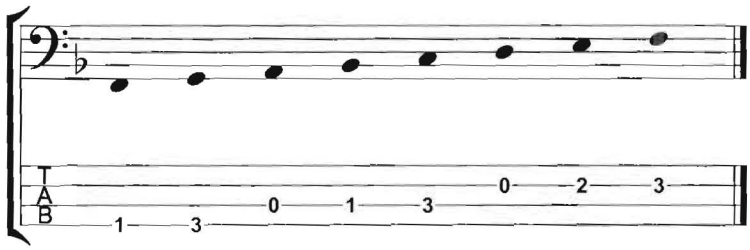
EXERCISE 65



EXERCISE 66

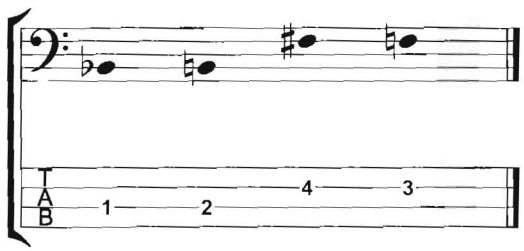


EXERCISE 67

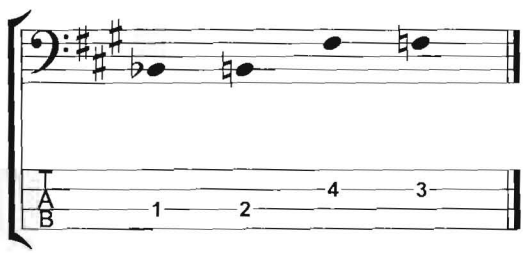


If we need to alter any of the notes that fall outside of our scale, for example sharpening or flattening a note that would otherwise be natural (Exercise 68), or making natural one of the notes altered by the key signature (Exercises 69 and 70), an accidental is required. This is a sharp, flat or natural sign placed just in front of a note.

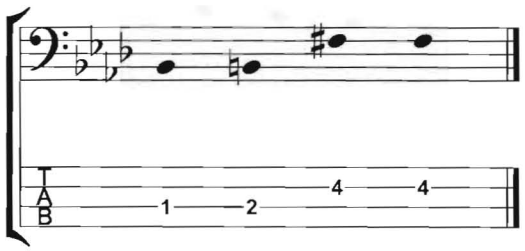
EXERCISE 68



EXERCISE 69

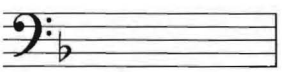
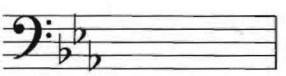
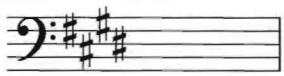
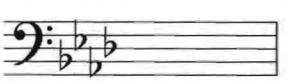
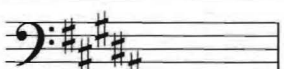
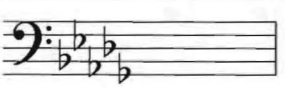
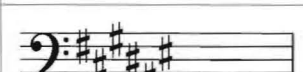
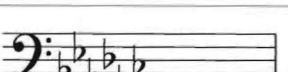
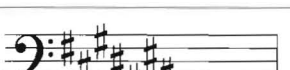
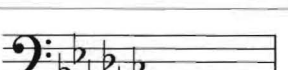


EXERCISE 70



Once used, an accidental remains in force until the end of the bar or until it is cancelled by a natural sign. It applies to all the notes of that name in the bar, without needing to be re-written. It doesn't normally apply to the octave, however, although there is some debate about this – or just laziness in the way some scores are written. Use your ears; don't insist on playing root/major seventh patterns on a disco chart when the score demands octaves. All the flat and sharp keys are shown below.

Key signature	Major key
	C No sharps or flats

Key signature	Major key	Key signature	Major key
	G major One sharp		F major One flat
	D major Two sharps		B♭ major Two flats
	A major Three sharps		E♭ major Three flats
	E major Four sharps		A♭ major Four flats
	B major Five sharps		D♭ major Five flats
	F♯ major Six sharps		G♭ major Six flats
	C♯ major Seven sharps		C♭ major Seven flats

Notice that every sharp or flat is placed exactly on the line or space of the stave representing the note it affects. This note is sharp or flat across *every* octave/position.

The order of the placement of sharps or flats is fixed. Adding sharps sequentially produces a 'cycle of fifths' ascending, with each root note a fifth above that of the key preceding it. The last sharp on the key signature is the seventh degree of the major scale for that key.

Conversely, adding flats sequentially produces a 'cycle of fourths' ascending, with each root note a fourth above that of the key preceding it. The last flat on the key signature is the fourth degree of the major scale for that key.

As we are dealing with 12 notes in our Western harmony, and because by continuing our cycle of fifths or fourths we ultimately arrive back at C, the key signatures are often illustrated in a circle like a clock. Moving clockwise produces a cycle of fifths for our sharps. Moving anti-clockwise produces a cycle of fourths for our flats. More importantly you need to be able to see a key signature and know immediately what key it represents, especially for sight-reading purposes. Try learning the keys with fewer sharps or flats first and then move on to the rest. Repetition and practice will be required.

13. PENTATONIC SCALES

We saw from our Blues Performance 1 chart that we could spice up a bassline by adding selected notes from a scale to the basic triad or seventh chord notes. Pentatonic scales are widely used in blues, rock, metal, and funk. They add notes to the basic major and minor triads. There are two pentatonic scales, the major pentatonic and the minor pentatonic. As their names suggest, they comprise five notes.

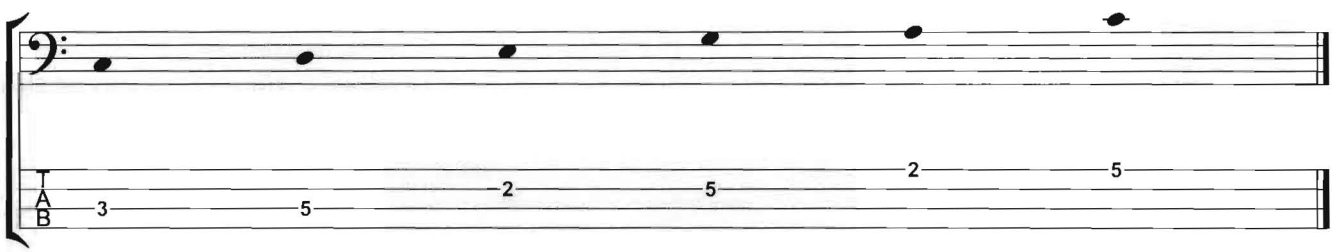
The major pentatonic

The major pentatonic has a formula just like our other scales and chords. The formula is: root/second/major third/fifth/major sixth (R + 2 + maj3 + 5 + maj6).

In the key of C this would give us the following notes: C (root), D (second), E (third), G (fifth), A (sixth), as shown in Exercise 71.

EXERCISE 71

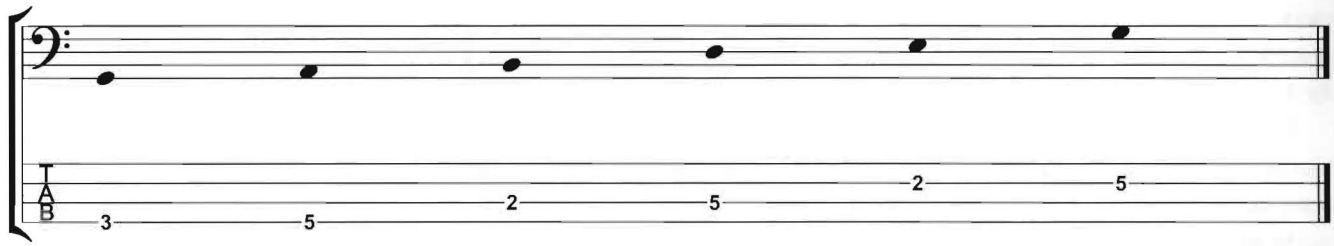
CD TRACK **24**



Exercise 72 shows a G major pentatonic scale.

CD TRACK **25**

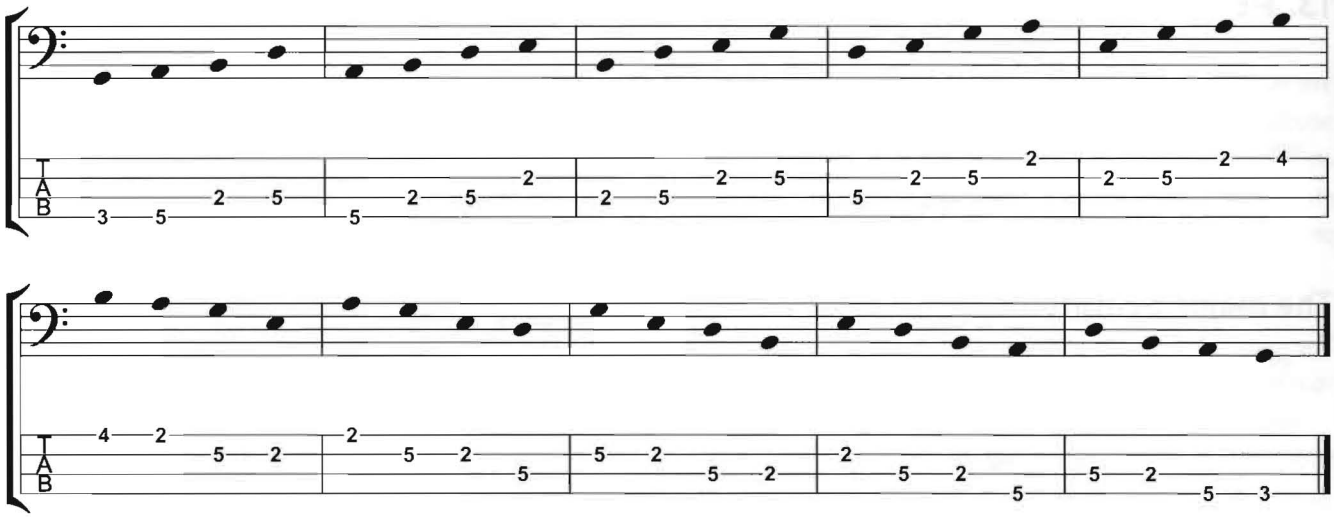
EXERCISE 72



Using the Scale Drills (see p150) will help you play the major pentatonic across the whole of your bass. Let's take scale drill five as an example (it's a common one for examiners, should you be thinking of getting formal education on the bass). And let's change the key to G so you get familiar with other key signatures. Exercise 73 shows the scale played from each scale degree in sequences across the strings without needing to move out of position.

CD TRACK **26**

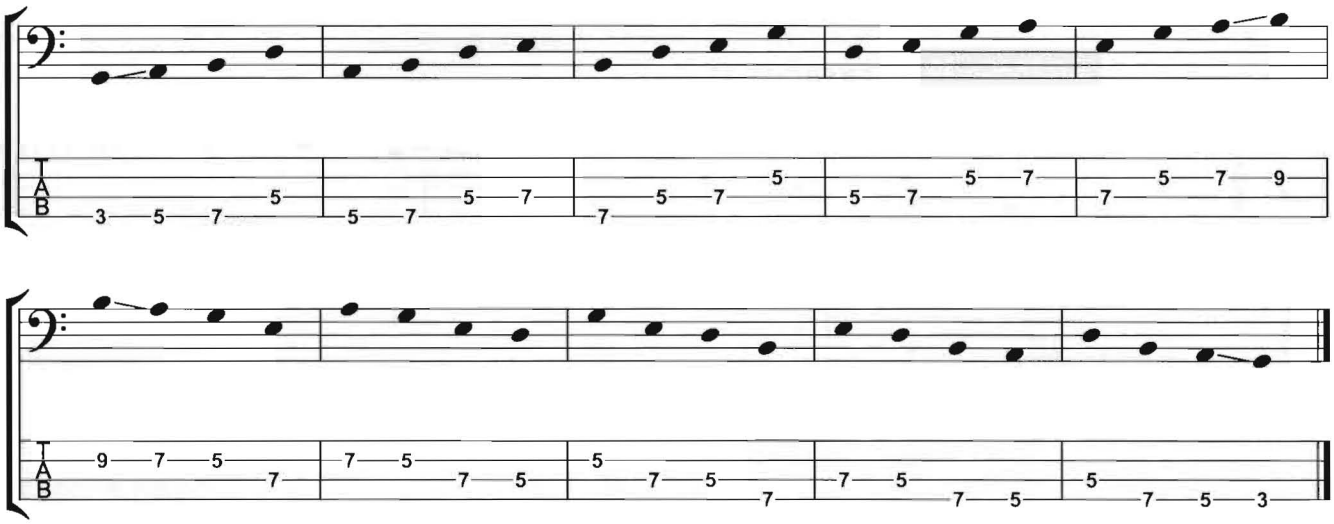
EXERCISE 73



Exercise 74 shows the scale incorporating slides up the strings even though the notes stay the same. Which sounds best? Which allows you to access the most notes without shifting? Can you see yourself using each scale pattern in different circumstances? Does knowing the individual notes help or hinder your playing?

EXERCISE 74

CD TRACK **27**



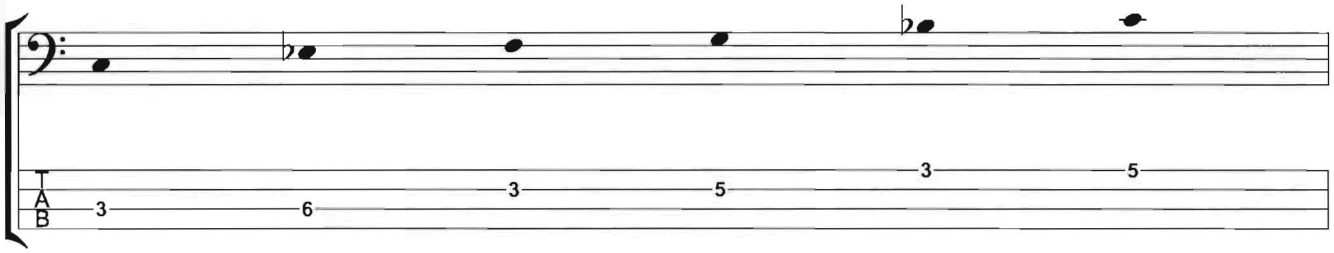
The minor pentatonic

The minor pentatonic has the darker, sadder sound associated with the minor third interval. The formula for a minor pentatonic is: root/minor third/fourth/fifth/minor seventh (R + ♭3 + 4 + 5 + ♭7, compared with the major scale).

In the key of C this would give us the following notes: C (root), E♭ (minor third), F (fourth), G (fifth), B♭ (minor seventh), as shown in Exercise 75.

EXERCISE 75

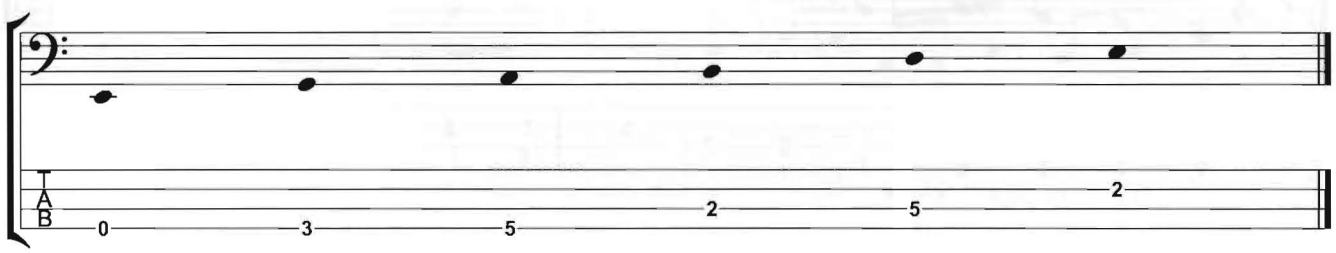
CD TRACK **28**



Exercise 76 shows an E minor pentatonic.

EXERCISE 76

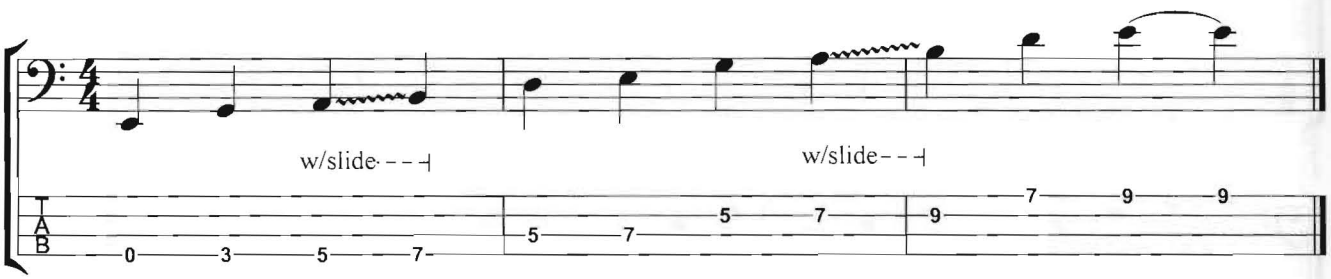
CD TRACK **29**



Using scale drill three as an example (you're practising all of them, right?) play the E minor pentatonic over two octaves. Exercise 77 adds slides to the scale.

CD TRACK 30

EXERCISE 77



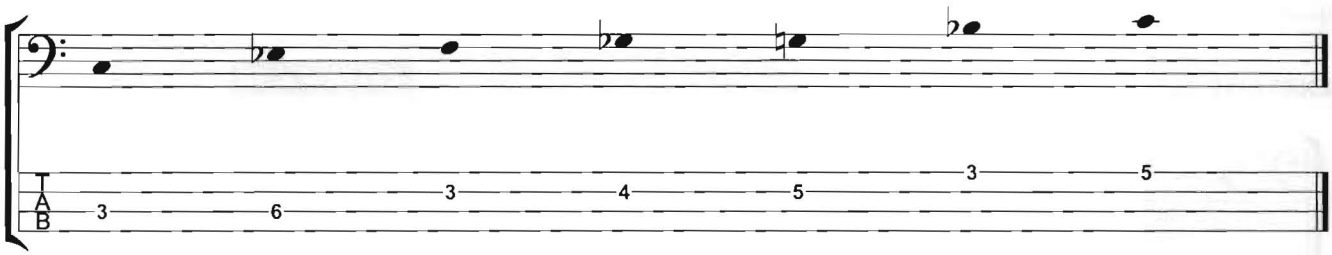
The blues scale

The blues scale incorporates all the notes from the minor pentatonic plus an additional note, the diminished or flattened fifth. The formula for a blues scale is: root/minor third/fourth/diminished fifth/fifth/minor seventh (R + ♭3 + 4 + ♭5 + 5 + ♭7, compared with the major scale).

In the key of C this would give us the following notes: C (root), E♭ (minor third), F (fourth), G♭ (diminished fifth), G (fifth), B♭ (minor seventh), as shown in Exercise 78

CD TRACK 31

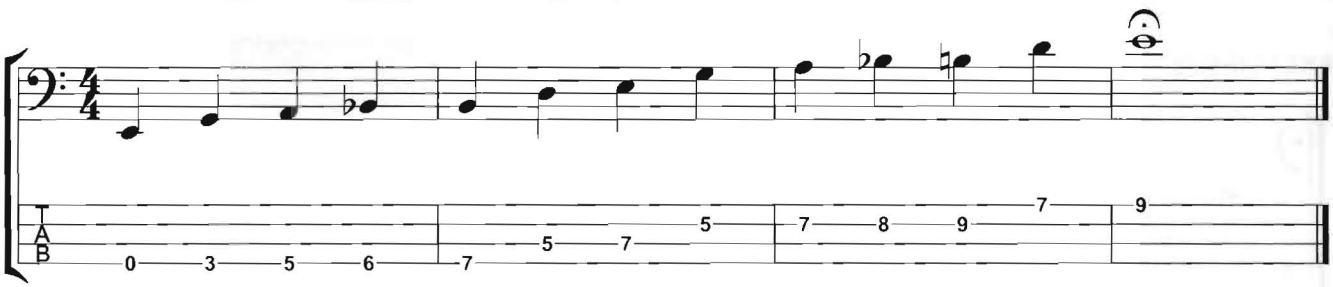
EXERCISE 78



In our E blues scale, that would be E G A B♭ B D. In Exercise 79 we apply scale drill three to the E blues scale.

CD TRACK 32

EXERCISE 79

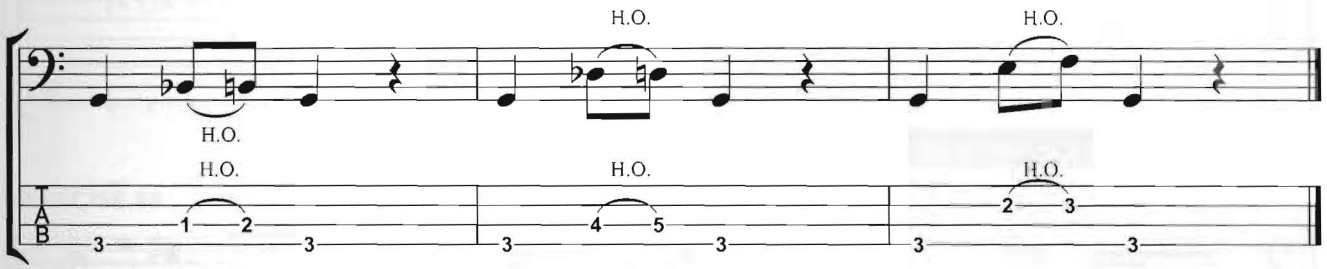


More pentatonics

Many players mix together elements from the major and minor pentatonic scales with the diminished fifth from the blues scale. Exercise 80 gives some examples of licks based on those elements.

EXERCISE 80

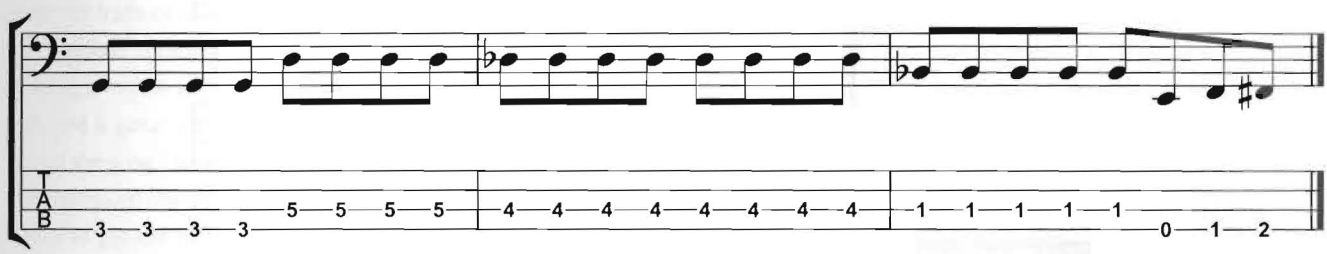
CD TRACK **33**



Left to right: minor third to major third; diminished fifth to perfect fifth; major sixth to minor seventh. These licks can also work in reverse: for instance, major third to minor third.

Note that the blues scale is not just used for the blues. The darker sound of Exercise 81 illustrates this. It is commonly used in metal and hard rock, the diminished fifth (or tritone) having a characteristic quality that was once named the 'diabolus in musica' (the devil in music) because of its sinister sound. With such a demonic background it is no surprise that the tritone was favoured by bands such as Black Sabbath.

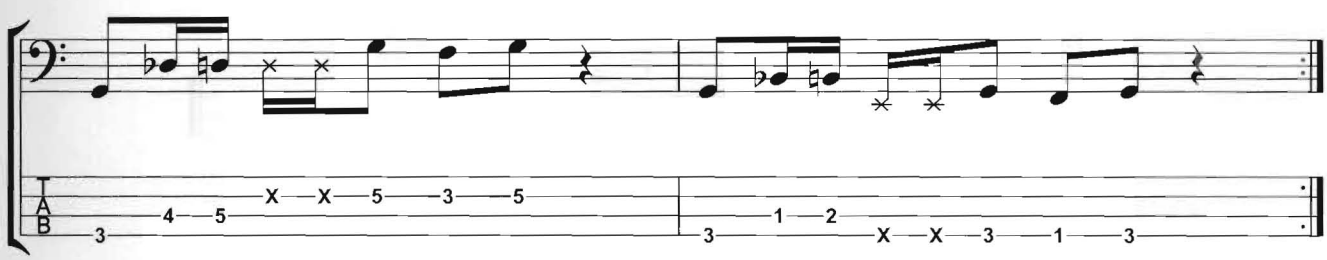
EXERCISE 81



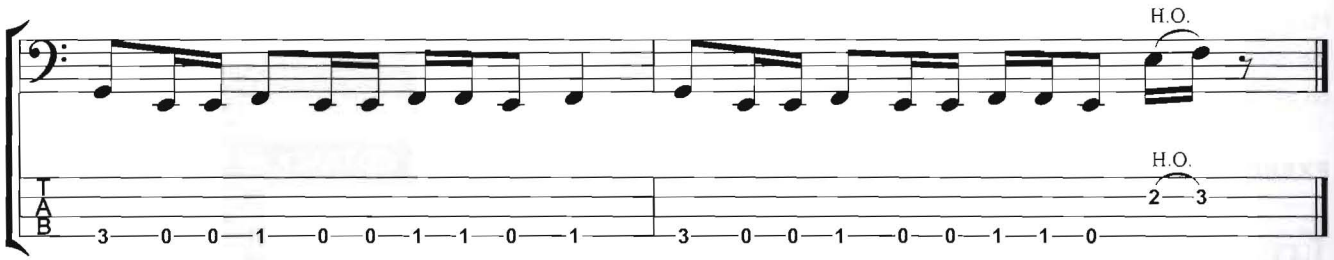
Exercises 82 to 88 provide several pentatonic riff ideas.

EXERCISE 82

CD TRACK **34**

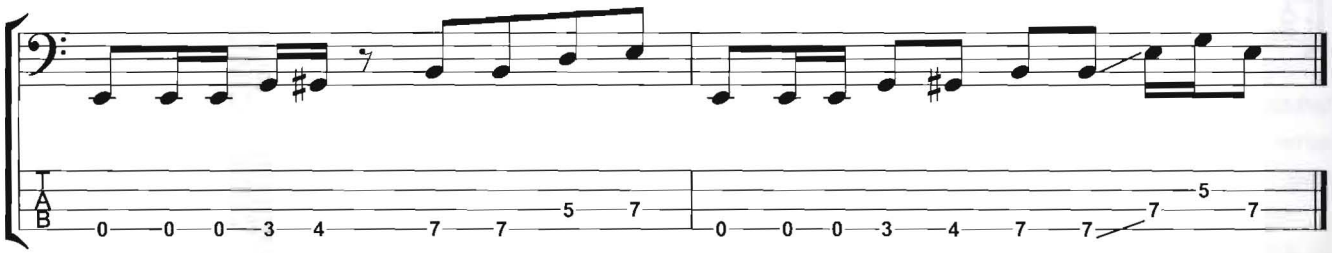


EXERCISE 83



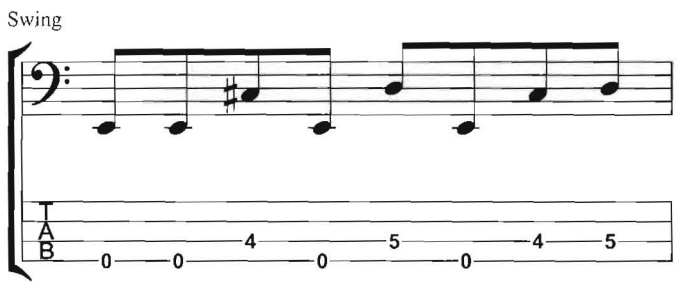
CD TRACK **35**

EXERCISE 84



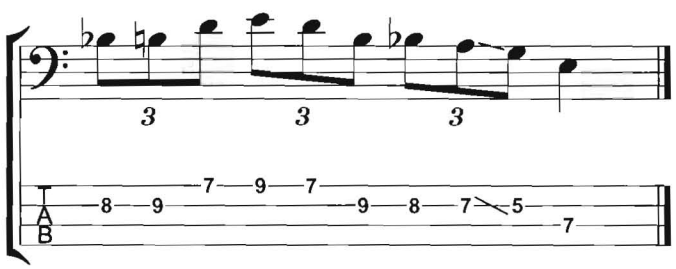
CD TRACK **36**

EXERCISE 85

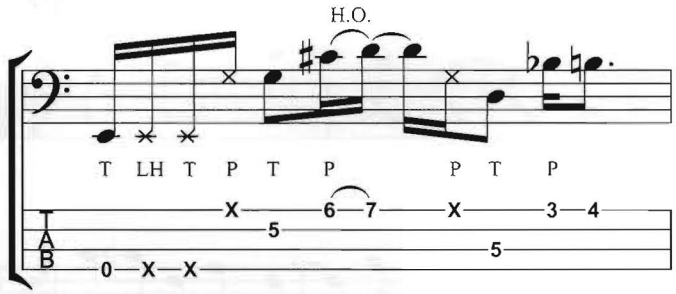


CD TRACK **37**

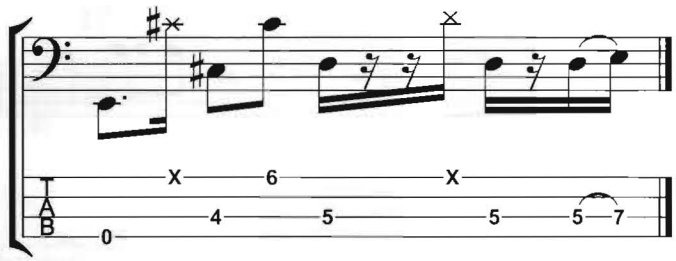
EXERCISE 86



EXERCISE 87



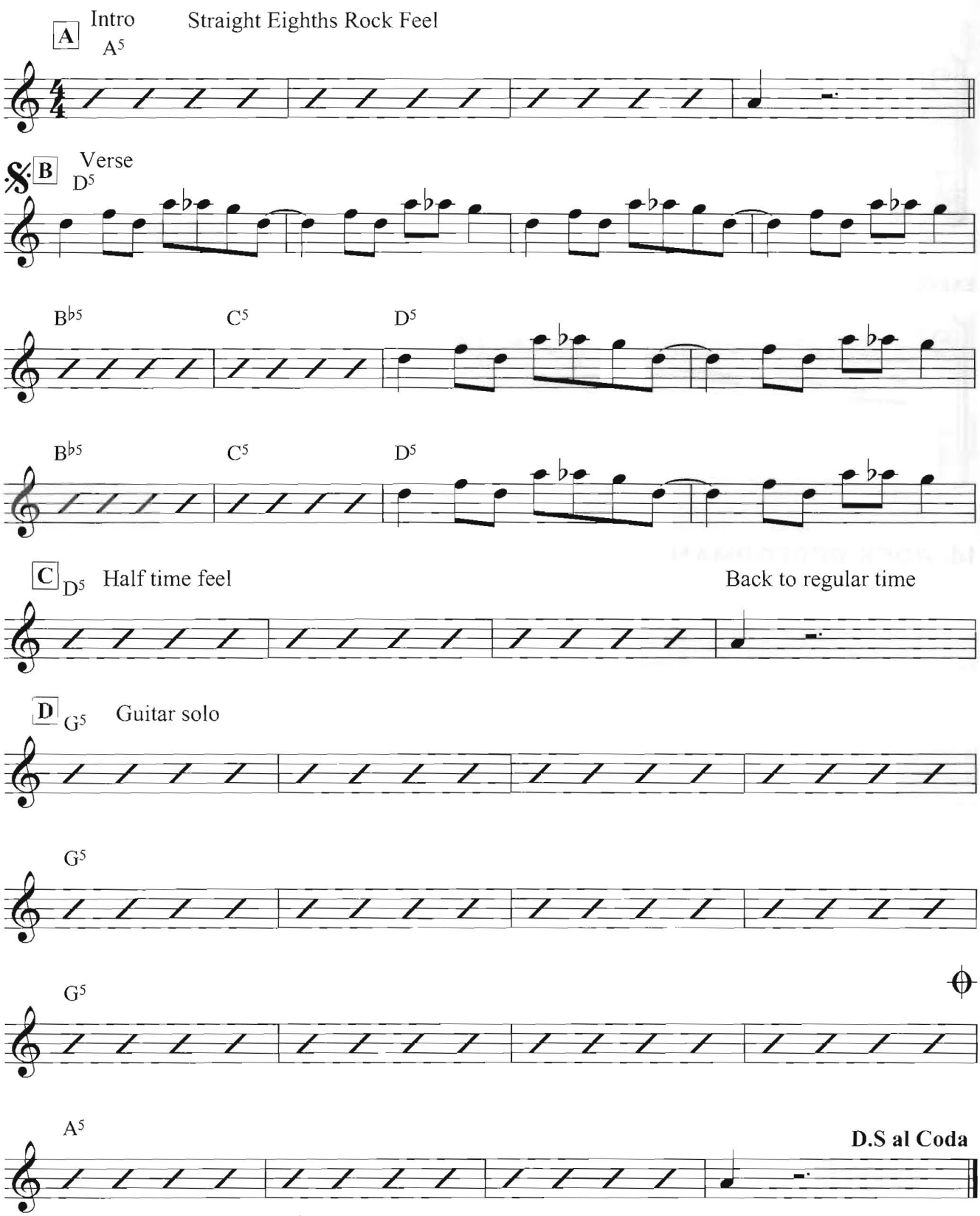
EXERCISE 88



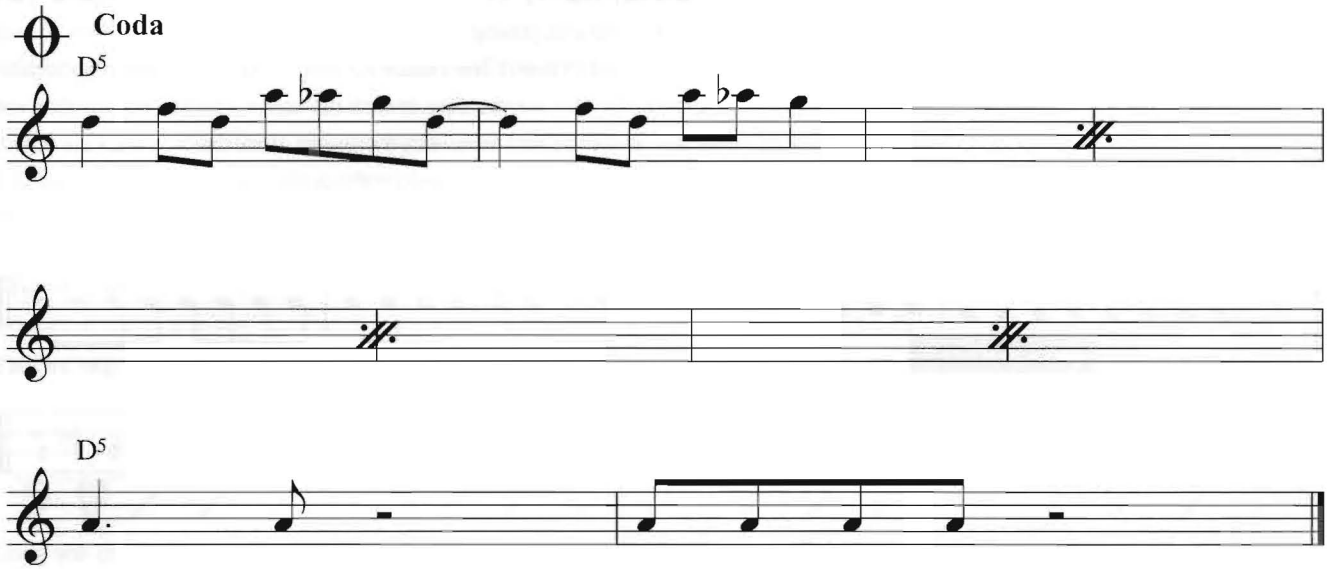
14. ROCK PERFORMANCE

This performance piece (Exercise 89) has been specially written to feature some of the common traits of rock music and rock guitar/bass. The chart consists of a four-bar intro (using power chords and pedal tones), a verse (using a blues-based lead line and power chords), a middle section in which the bass can play a prominent part (with a half-time feel) and a guitar solo section of 16 bars in the key of G minor. A coda section is used to end the song. The whole sequence is played twice, and you need to keep an eye on the chart; although the chords and form are fairly straightforward, the different sections make it easy to get lost or separated from the rest of the band. CD track 38 is without bass.

CD TRACK 38 & 39 **EXERCISE 89**



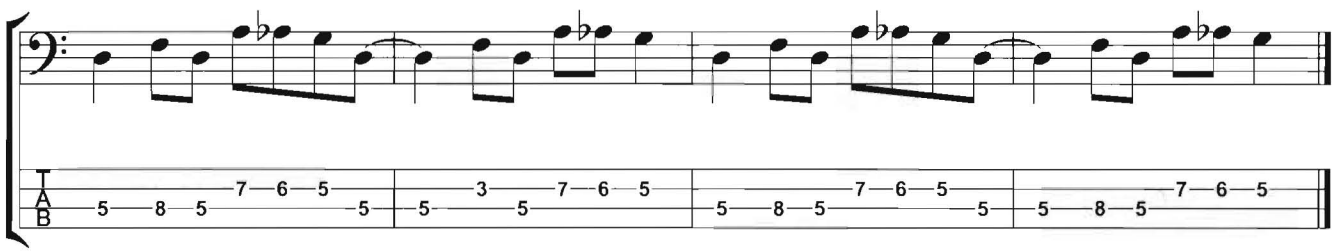
Exercise 89 *continued*



The chart is written in the treble clef – a common occurrence – because the music is for the guitar riff. The matching bassline is written out later, separately. You would rarely be given this information, so you would need to either read the treble clef, ask the guitarist to play the riff, or use your ear and scale knowledge to work out the riff.

Playing the riff (Exercise 90) is optional. The band leader may not want it played on the bass, but it is always a good idea to learn it anyway, both for solo inspiration and perhaps for the odd double-up with the guitar.

EXERCISE 90

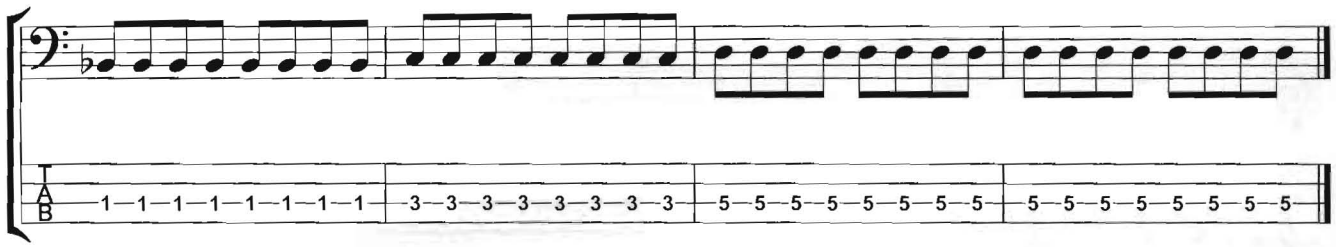


The chart includes an intro, played just once, and uses letter sections for quick reference to each section of the song. This is a common practice in chart writing, especially for tunes that don't follow a standard chord progression (unlike our blues). The half time feel at letter C means the music is still in 4/4, but feels as if it is at half tempo.

Creating a bassline

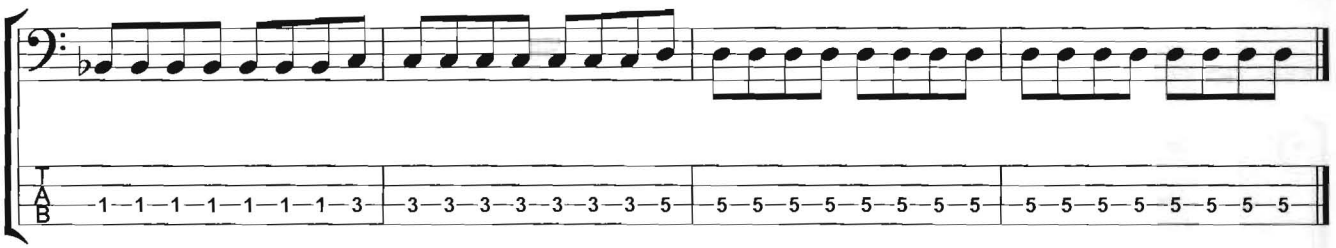
You will often find that a guitarist playing rock music will use power chords, which consist only of roots and fifths (and octaves). The reason for this is that these sound good with distortion. The starting point for any bassline in rock has to be a simple eighth-note line that is solid, relentless, and in perfect time with the drums (Exercise 91).

EXERCISE 91



Riffs, fills and fancy tricks all take second place to this basic principle. Listen to any good rock band, from Deep Purple to Mr Big, and you will find that the bassist can deliver great, solid, eighth-note basslines. Even amongst bands that stray away from that classic formula, such as The Who, you will still find eighth-note basslines at work. One neat trick is to anticipate the next chord change by one eighth-note (Exercise 92). Sting is a master of this, employing it in his work with The Police and as a solo artist.

EXERCISE 92



The half-time feel section, starting at bar 17 in the chart, leaves room for some bass breaks or flashy playing as an option. It is one of those annoying features of music that bass breaks are usually accompanied by half the band dropping out. It takes a special skill to perform even a short solo spot when there is virtually no accompaniment, but that may be required at the half-time section. Or maybe the bandleader will want to leave all the glory to the guitars. That's OK. Just think about who is writing the cheques. Whatever you choose, with only the harmony of a D5 chord you do have a lot of note freedom. Study the minor pentatonic and blues scale sections. If you are comfortable with these ideas, you can add other tricks such as slides, hammer-ons and pull-offs. Remember, however, that the priority is to play the chart perfectly.

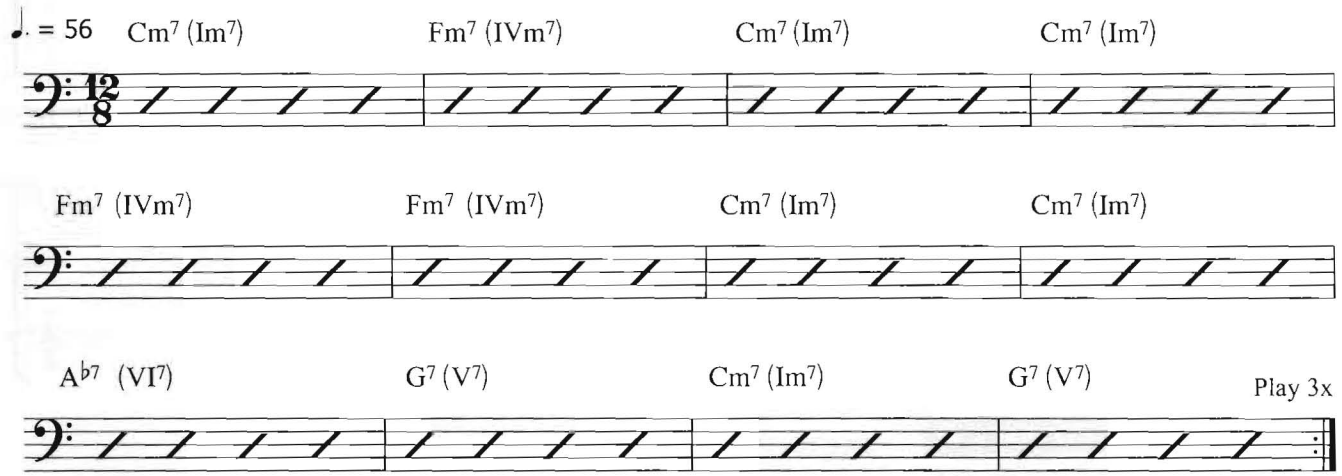
15. BLUES PERFORMANCE II (MINOR BLUES)

Following on from our original blues chart, let's see how a minor blues chord progression works (Exercise 93). The minor blues involves more varied use of the types of seventh chords we have studied and is a great way to combine the theory with practice. It is still a 12-bar based progression and is often played at a slower tempo. It is also favoured in other styles of music, such as Latin. CD track 40 is without bass.

The chart

EXERCISE 93

CD TRACK **40**



Bar one is based on a minor seventh chord (the I chord for this progression). At bar two there is a change to the IV chord, Fm7. This sudden change to the IV chord is a characteristic of quick change blues. The same technique could be applied to our Blues Performance I chart by adding a IV7 chord at bar two. The quick change has nothing to do with tempo; it's simply another variant on the blues progression. Bar three returns to the I chord until bar five, where we return to the Fm7 (IV). Bar seven moves back to the I chord. Things get interesting at bar nine where a dominant seventh chord is used on the sixth degree of the minor scale (VI7). In our key of C minor, that's an A♭7 chord. The remainder of the chart returns to the V I V movement of a regular blues. Repeat marks at the end tell you to play the piece three times.

Details of the chord tones (notes for each chord) are provided in the Seventh Chords section (p163). You can play the basic triad of each chord – minor (Cm7 Fm7) or major (A♭7 G7) – under each chord. You don't need to play all the notes of the chord.

The feel and tempo have been changed from the major blues exercise. The feel is swung in triplet style over a 12/8 time signature (see Music Reading, p203).

The chart above has no bassline, which is often how you would see it in a rehearsal. The next two exercises are guide parts to show you how to come up with a bassline. After that there is a full bassline for the whole chart.

Creating a bassline

The feel is vital. Our new groove can be counted as 'one-ta-ta, two-ta-ta, three-ta-ta, four-ta-ta'. The quarter-note metronome click now carries three eighth-notes, which is why the quarter-note requires a dot at the tempo mark. Pick a simple groove first and embellish it when you feel comfortable.

Sometimes a chart will have all the chord symbols written out, as above, but you will also be given guide parts, as below. Guide parts are often written in a hurry by the session leader and might just show a one-bar example or, as here, the notes that should be played over several of the chords in the chart. A large degree of experience, studio savvy, and intuition are required. Do you play each and every chord exactly as shown in the guide part? Can you add fills or variations? The answer, of course, is that it depends on the session leader.

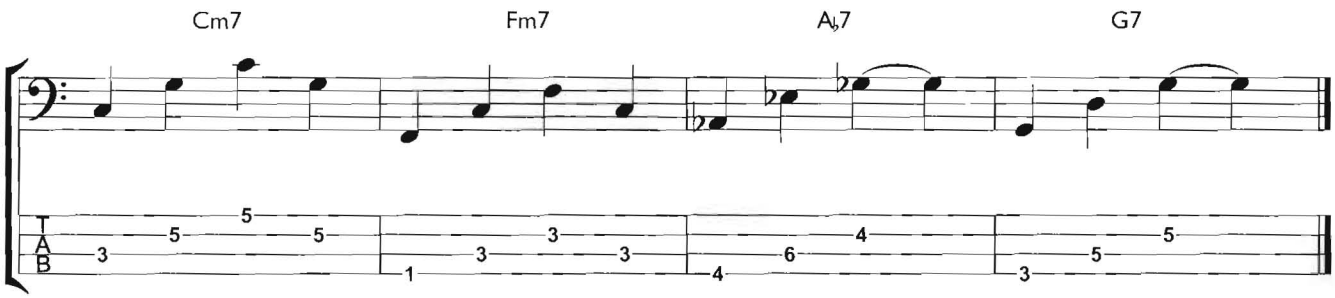
Carol Kaye, a studio veteran of the 1960s and 1970s, played from many guide parts laid down by incredible producers such as Brian Wilson of The Beach Boys. Often it was a case of sticking to the written part, albeit with a slight twist when the creative juices were flowing. She recalls, "Brian never changed the bassline during any of the sessions. Although I did talk him into using one of my fuzz-tone pedals on one date with the same bassline [to 'Good Vibrations']."

The two exercises below show suitable lines to accompany each of the four chords in the piece: Cm7, Fm7, A♭7, and G7.

The first version (Exercise 94) involves a very simple groove using mainly roots, fifths, and octaves.

CD TRACK 41

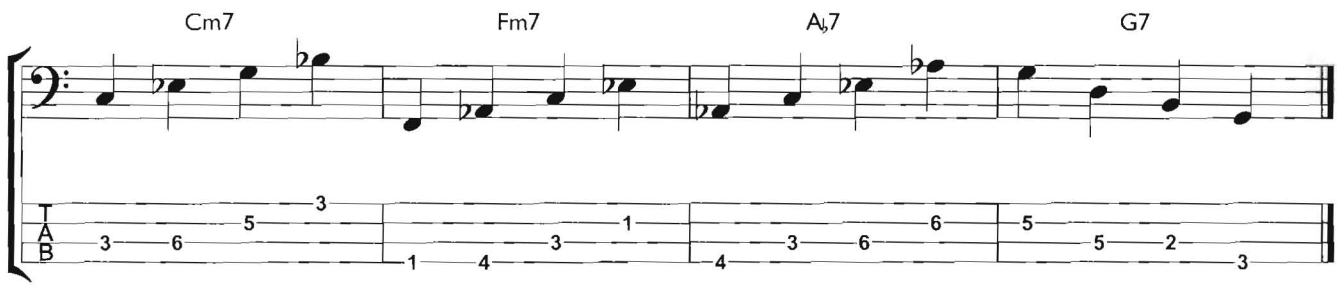
EXERCISE 94



The second version (Exercise 95) plays a walking line, outlining the chords with the notes from the seventh chords.

CD TRACK 41

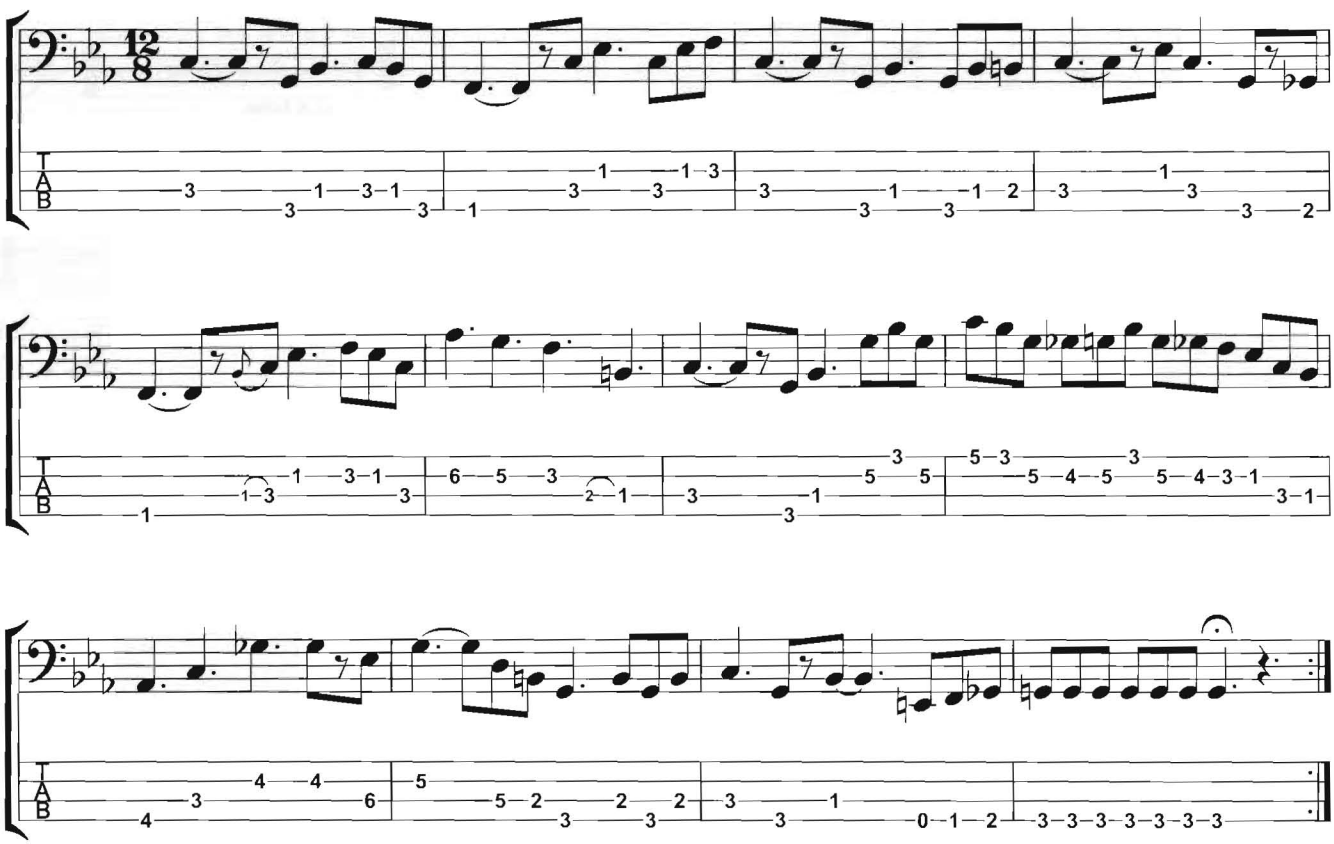
EXERCISE 95



And the third chorus (Exercise 96), written out in full below, has a new groove, combining the melodic content of the second chorus, a common 12/8 rhythmic feel, and passing notes that lead us chromatically into the next chord. (A complete play-through is often referred to as a 'chorus', even though there is no formal verse/chorus structure here as there would be in a pop song.)

EXERCISE 96

CD TRACK 41



16. MAJOR SCALE HARMONY

Most songs consist of several chords linked together in a progression. Would it be helpful if we could see the link between these chords? Could we concentrate on other aspects of our groove if we understood that the chords, although different, rotate around a fixed key centre? Would it be good if our soloing over many chords could be simplified to one scale? I'd say yes, yes, and maybe: worth investigating, that's for sure. The key to these answers lies in harmonising a scale; that is, building chords upon each scale degree. Let's start with a C major scale and harmonise it with our simplest chords, the triad.

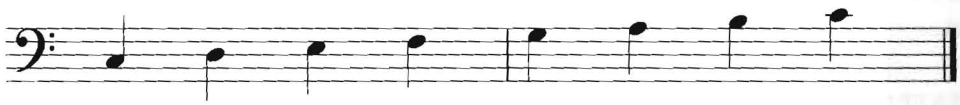
Harmonising in triads

The formula is relatively straightforward, even though there is a fair amount of material involved.

Exercise 97 is our C major scale:

CD TRACK 42

EXERCISE 97



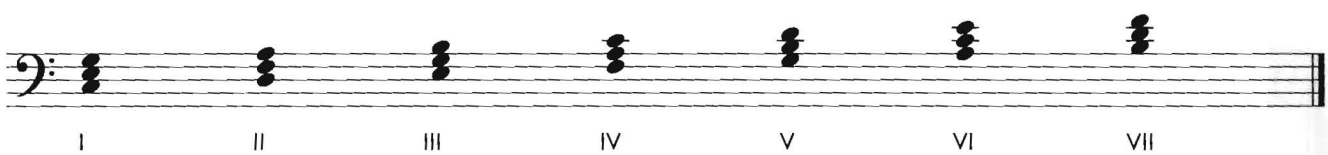
Exercise 98 shows that scale with chords built on just the first and second scale degrees to illustrate the chord-building process. Bars two and three show the same notes written as arpeggios, which is when chords are played a note at a time.

CD TRACK 42

EXERCISE 98

When we build the chord, adding the third and fifth, we simply add extra notes in the two spaces (C E G) or on the lines (D F A) above the root, just as we did in the chapter on Triads (p158). Our first chord is a C major triad, but the second is a D minor triad. Here we see the C major scale fully harmonised:

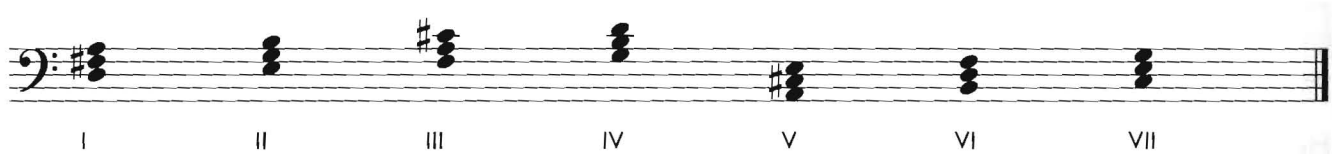
EXERCISE 99



Roman numerals have been added below each scale degree and associated chord. The I IV and V chords are major; the II III and VI chords are minor; and the VII chord is diminished. The order of chords (I major, II minor, III minor, IV major, V major, VI minor, and VII diminished) is the same for any harmonised major scale.

Many musicians refer to chord progressions by their roman numerals, so they can easily be transposed to different keys. They would talk of a VI-II-V-I progression, for example, which would be Amin-Dmin-G-C in C major but Bmin-Emin-A-D in D major. Here we see the D major scale harmonised:

EXERCISE 100



Harmonising in sevenths

Often music is harmonised using the more colourful seventh chords. The principles are the same as above, although the chords now take on a more advanced structure.

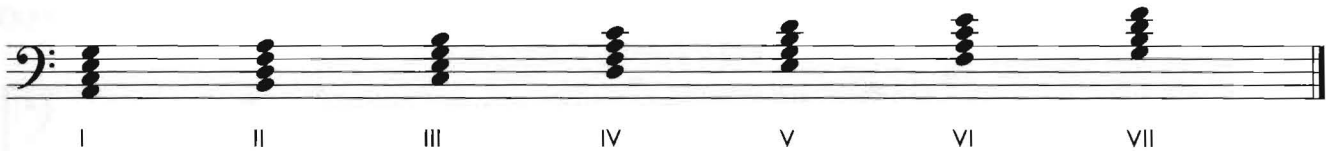
Exercise 101 shows the C major scale with seventh chords built on just the first and second scale degrees to illustrate the chord-building process. The subsequent bars show the same notes written as seventh chord arpeggios.

EXERCISE 101

We have now added another interval to our triad. This can be viewed in two ways; as a third above the last interval, or as a seventh above the root. The roman numeral system stays in place.

Here is the scale fully harmonised with seventh chords.

EXERCISE 102



The new order of chords is I major seventh, II minor seventh, III minor seventh, IV major seventh, V dominant seventh, VI minor seventh, VII half-diminished seventh.

Our blues performance charts use the roman numeral system, but in blues harmony any chord can be a dominant seventh chord to achieve the blues sound.

Finding the key centre

We use this harmony to find the key centre of a piece of music – the key signature around which the music is based. This is done by examining the chord progression and seeing if it fits into the harmonised scale.

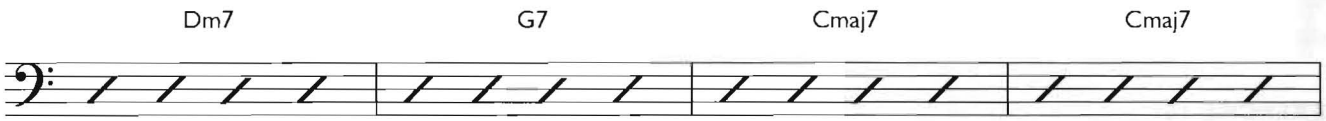
If it does, you have found the key centre. If it doesn't then you may be dealing with more than one key centre, a chord substitution, or simply a composer who doesn't want to write according to basic harmonic principles. Remember, unlike many other disciplines, there are no strict rules to music. If it sounds good to the composer, that's all that matters.

Exercise 103 shows a chord progression: Dm7 G7 Cmaj7. The key centre is C. All the chords are harmonised from the C major scale. Confirm this yourself. In our harmonised scale in C, the II chord is a D minor seventh, the V chord is a G dominant seventh and the I chord is a C major seventh.

A good rule of thumb for finding key centres is to locate the dominant chord, as it only appears once in the harmonised scale, whereas minor and major chords appear in

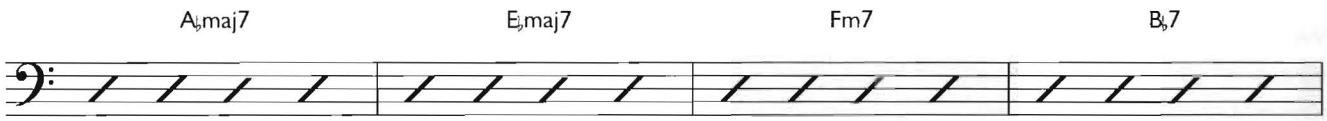
several places. (As mentioned above, the dominant chord is used more freely in blues harmony.)

EXERCISE 103



Can you work out the key centre from this progression? A♭maj7 E♭maj7 Fm7 B♭7.

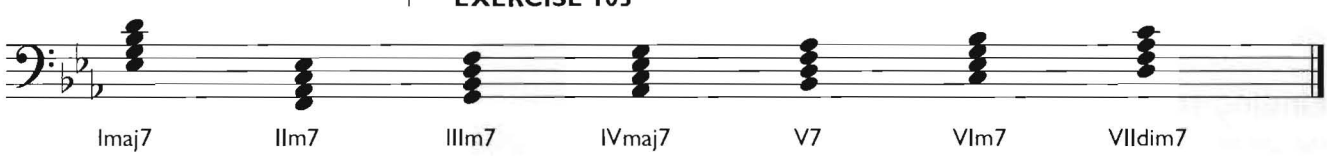
EXERCISE 104



Follow these steps:
Find the dominant chord. Answer: B♭7. What is the I of a B♭7? Answer: E♭maj7.
Harmonise an E♭ major scale in sevenths – what other chords fit?
What is the IV of E♭maj7? Answer: A♭maj7.
Does the remaining chord in our sequence fit? Answer: yes. The Fm7 is the second degree of an E♭ scale and the chord is a minor seventh.
What is the key centre? Answer: E♭ major.

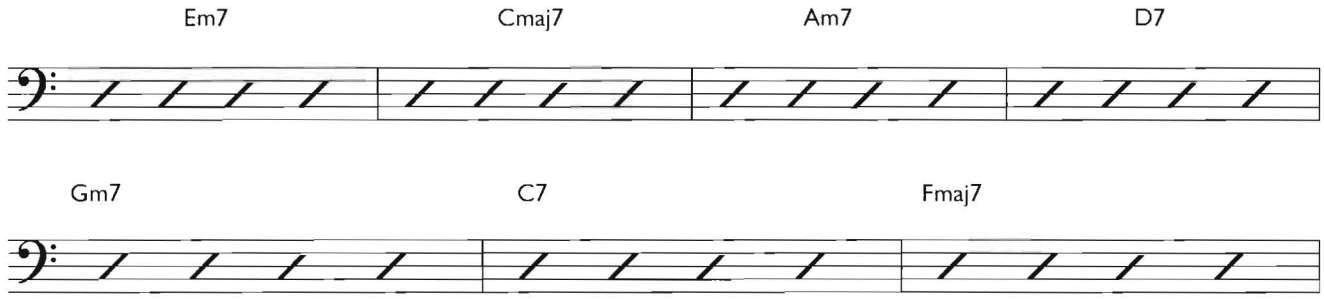
Here's the E♭ major scale harmonised to confirm this. Note: we are using a key signature in this example instead of accidentals (see p171).

EXERCISE 105



A further progression illustrates how it is easy to be distracted by the addition of further chords in a progression: Em7 Cmaj7 Am7 D7 Gm7 C7 Fmaj7.

EXERCISE 106



Follow these steps:

Find the dominant chord. Answer: D7 and C7. This suggests either a chord substitution or a key change. What is the I of a D7? Answer: Gmaj7.

Harmonise the G major scale in sevenths to see if any other chords fit. Answer: the Em7 is the VI chord, the Cmaj7 is the IV chord, and the Am7 is the II chord. The G based chord is a minor seventh and so does *not* function as the I chord.

Find the next dominant. Answer: C7. What is the I chord of C7? Answer: Fmaj7. Harmonise an F major scale in sevenths to see if our remaining undefined chord fits. Answer: yes. It's a II chord in F major. Our key centre changed at this point.

Analysis: VI IV II V in G major, followed by II V I in F major.

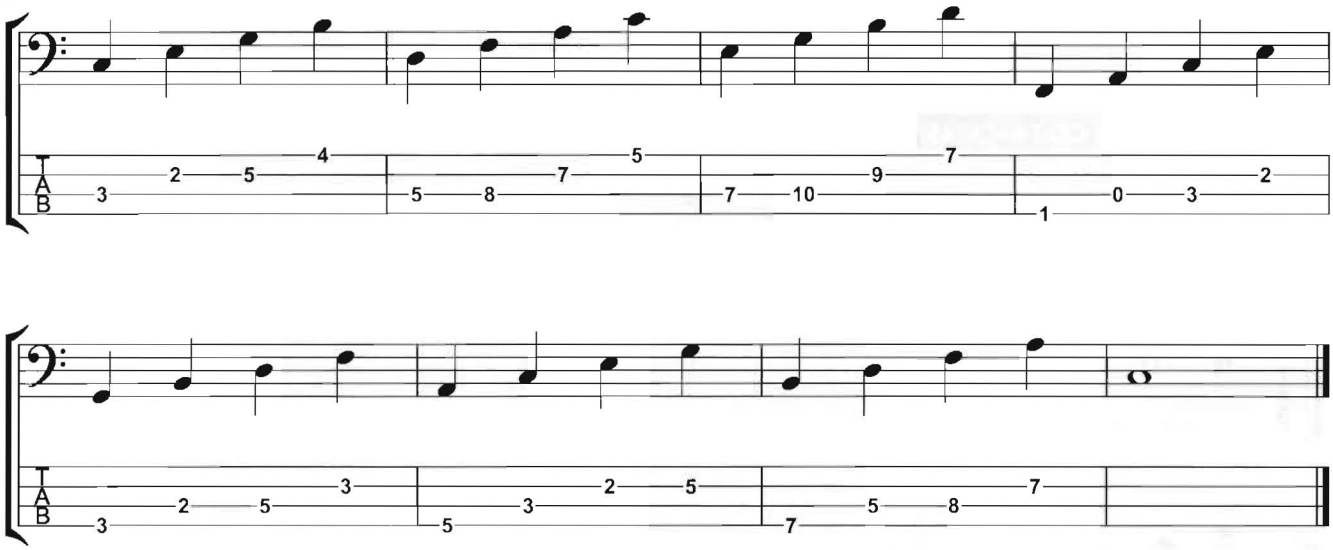
In time you won't need to harmonise the scale; these patterns will start to become second nature. The way to practise is to obtain a jazz 'real book', a book full of jazz tunes with standard chord changes, and analyse the key centres.

Improvising through the scale

Improvising through the harmonised scale is a fun way to learn these concepts and develop your ear. Exercise 107 plays each chord in a C major scale in an arpeggiated fashion, starting on the root of each chord.

EXERCISE 107

CD TRACK **43**



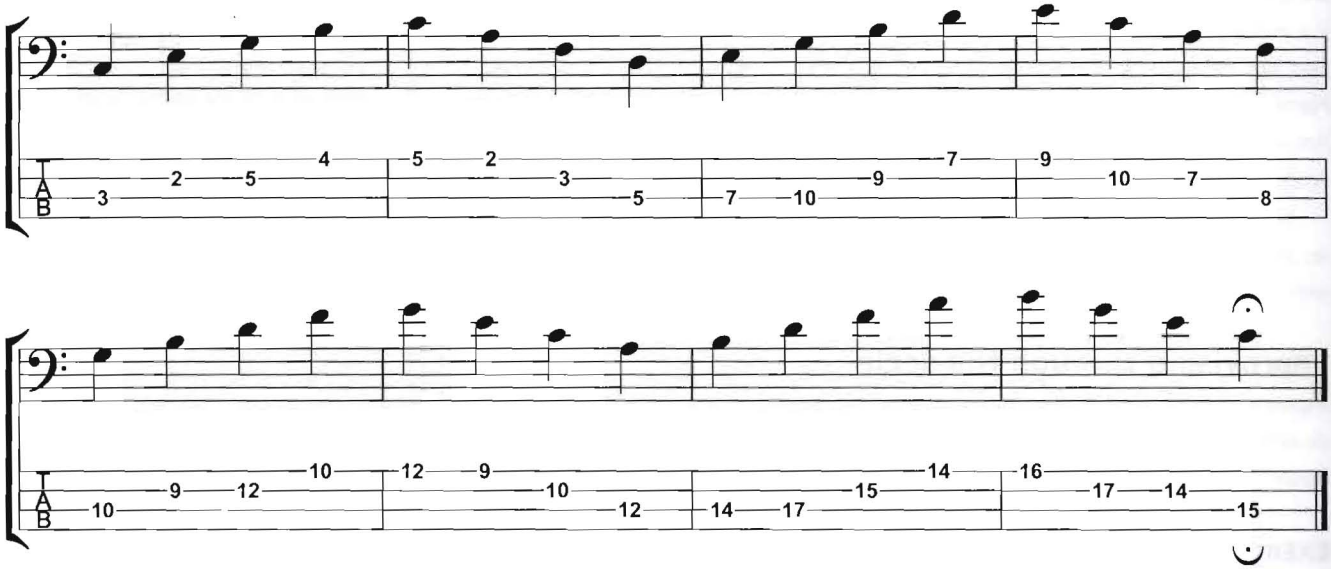
SLASH CHORDS

As you may recall from our studies of the scale, triad, and seventh chords, there is always a central tonality to which each chord relates. This is our root. In these exercises, the root of the chord is also its lowest note. But that is not necessarily the case. When chords are inverted (see Inversions, p201) the root won't be the bottom note. These are sometimes called slash chords, because they are written with the bass note following the chord name, separated by a slash: C/B♭, for example.

Exercise 108 plays the exercises up the I chord and down the II chord until we reach the I chord at the octave position.

CD TRACK **44**

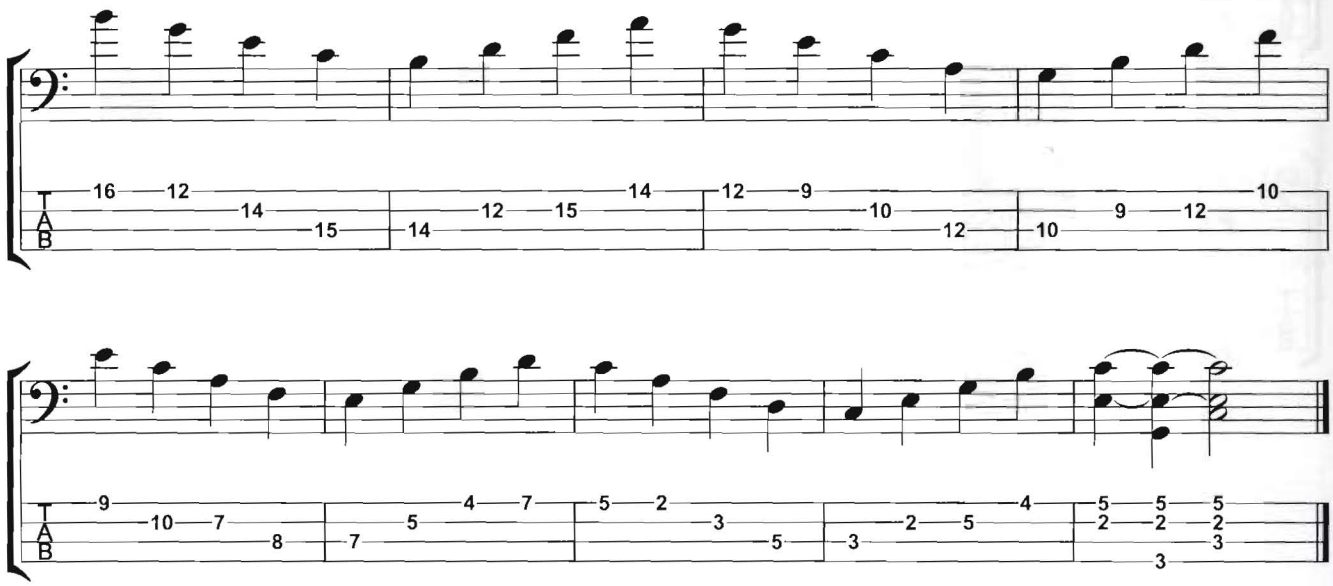
EXERCISE 108



In Exercise 109, the descending pattern reverses the roles, ie, down the I chord and up the VII chord.

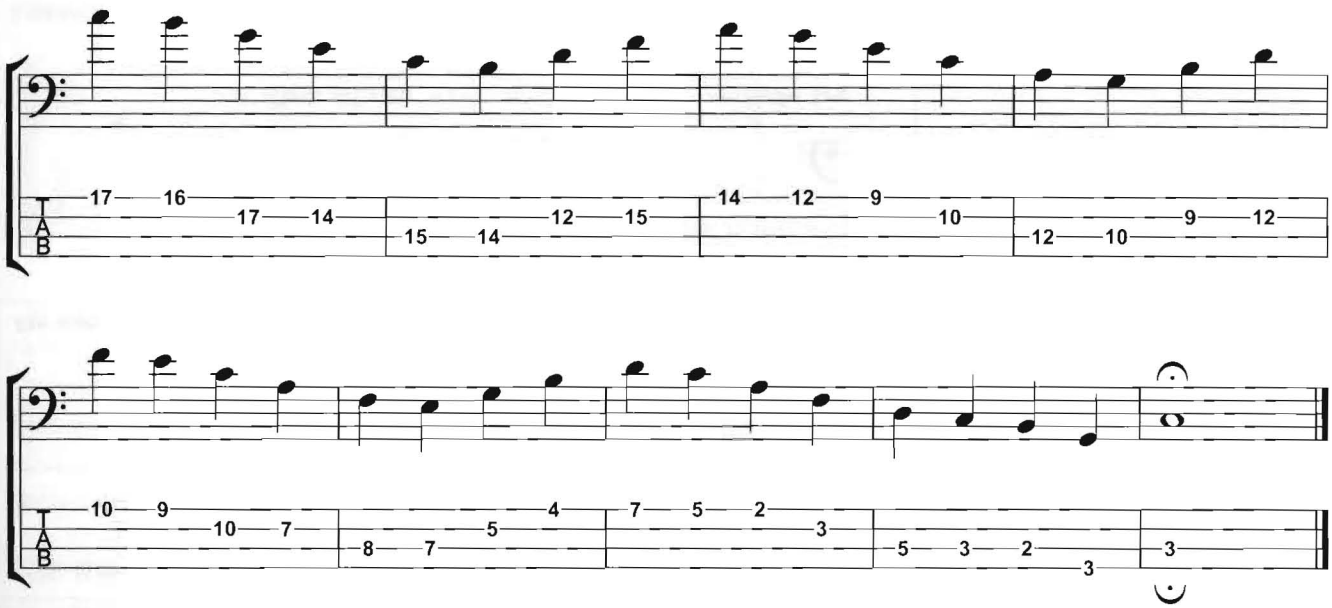
CD TRACK **45**

EXERCISE 109



Exercise 110 shows another option. Starting on the root of the chord and then descending means the four-note pattern doesn't start on the root of the next chord, making for a melodically interesting improvisation.

EXERCISE 110



17. MINOR SCALES

One concept that has always been present in Western music is the major/minor relationship. For every major scale there exists a relative minor. Chords are essentially a combination of major and minor sounds. The major tonality is happy and bright, while the minor sound is sad and dark; both reflect life itself.

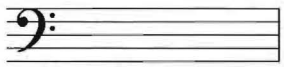
Minor scales can be confusing. It's not the scales themselves; it's the terms used to describe them. When classical instruction can differ from contemporary instruction, rock uses different terms to jazz, and the UK and the US use terms in diverging ways, it's no surprise there's some confusion out there. What we need is a comprehensive guide to minor scales...

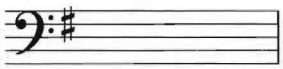
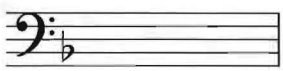
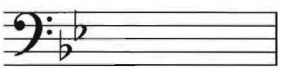
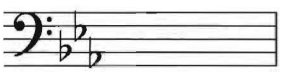
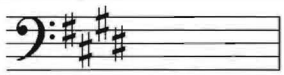
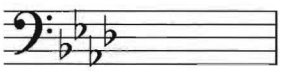
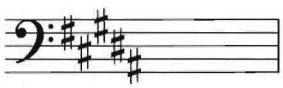
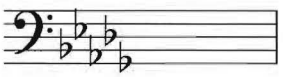
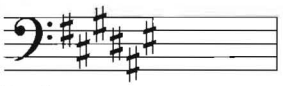
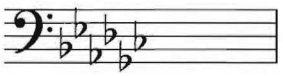
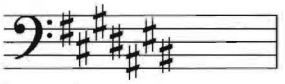
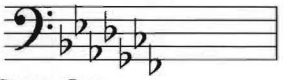
The relative minor

In our study of key signatures we saw how a major key was created based on each of the 12 notes in our musical alphabet. But many songs are written in a minor key, using a scale with the distinctive minor tone quality. But you don't need to learn 12 minor key signatures, as each major key signature has a relative minor using the same sequence and location of sharps or flats. C major has a key signature with no sharps or flats, so it makes sense to find out which minor key that also applies to. The process is simple. If you move six scale degrees up the major scale, you will find the tonic of the relative minor key; the tonic is the starting point for the scale and the note that gives it its name. The sixth degree of C major is A. That makes A the relative minor of C, with no sharps or flats in its key

signature. In G major, the sixth degree of G is E. E is the relative minor of G and, like G major, has one sharp (F♯) in its key signature. And it works the other way round: every minor key has its relative major, which you find by moving three degrees up the minor scale (a minor third). The relative major of F minor is thus A♭ major; a minor third up from the tonic of the minor scale.

The diagram below shows all the minor key signatures, with their relative majors.

Key signature	Minor key	Relative major key
 No sharps or flats	A minor	C major

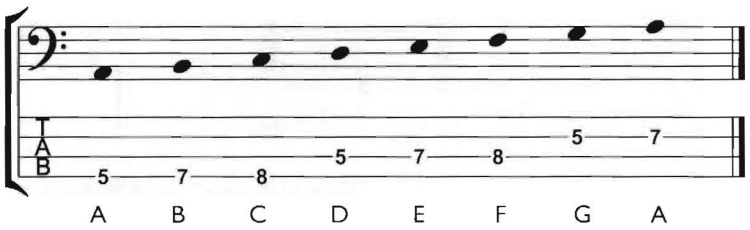
Key signature	Minor key	Relative major key	Key signature	Minor key	Relative major key
 One sharp	E minor	G major	 One flat	D minor	F major
 Two sharps	B minor	D major	 Two flats	G minor	B♭ major
 Three sharps	F♯ minor	A major	 Three flats	C minor	E♭ major
 Four sharps	C♯ minor	E major	 Four flats	F minor	A♭ major
 Five sharps	G♯ minor	B major	 Five flats	B♭ minor	D♭ major
 Six sharps	D♯ minor	F♯ major	 Six flats	E♭ minor	G♭ major
 Seven sharps	A♯ minor	C♯ major	 Seven flats	A♭ minor	C♭ major

The natural minor

Our first minor scale is the natural minor, also known as the descending melodic minor, the Aeolian mode, and the pure minor scale. To find it, we play the notes of C major, but starting from A, the tonic of the relative minor of C, and continue to the octave.

EXERCISE 111

CD TRACK **46**



The resulting intervals give us the following scale formula: root/second/minor third/fourth/fifth/minor sixth/minor seventh (R + 2 + ♭3 + 4 + 5 + ♭6 + ♭7, compared with the major scale).

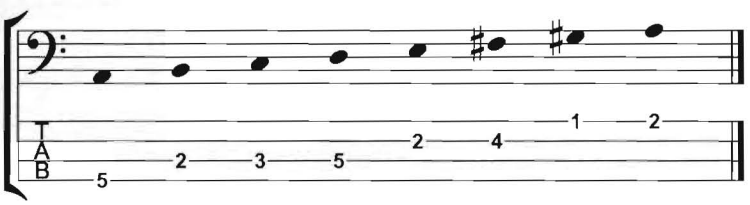
Contemporary players will view this as one scale and play it up and down the same way. Classical piano instruction takes a different view of the scale, thinking of it as the descending version of the melodic minor scale.

The melodic minor

The melodic minor scale, also known as the ascending melodic minor, or jazz melodic minor, takes the natural minor scale and sharpens the sixth and seventh degrees.

EXERCISE 112

CD TRACK **47**



The resulting intervals give us the following scale formula: root/second/minor third/fourth/fifth/sixth/major seventh (R + 2 + ♭3 + 4 + 5 + 6 + 7, compared with the major scale).

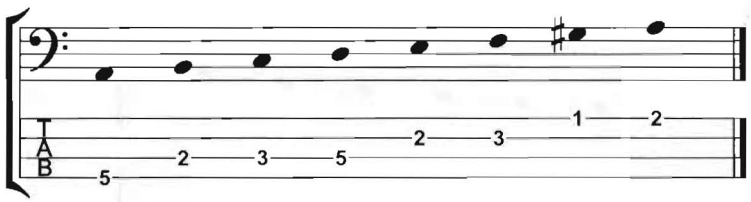
Confusion can set in until it's clarified that classical theory normally talks of just two minor scales, the harmonic minor (coming next) and the melodic minor. The melodic minor ascends in the manner described here but descends as per the natural minor. The reason given is that melodies in a minor key tend to use sharpened sixth and seventh degrees when going up but flatten the notes when coming down. Jazz, rock, blues, country, or funk musicians, however, tend to treat these as two separate scales, each ascending and descending in the same pattern.

The harmonic minor

You'll be pleased to hear this scale has just one universally accepted version and that it goes up and down in the same way, whether used in classical or contemporary music.

CD TRACK 48

EXERCISE 113



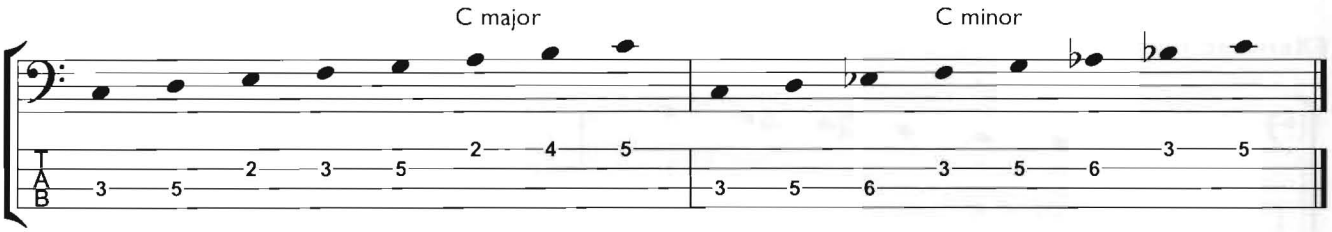
For reasons explained in the next chapter, Minor Scale Harmony, the harmonic minor sharpens the seventh degree of the natural minor scale to give the following scale formula: root/second/minor third/fourth/fifth/minor sixth/major seventh (R + 2 +♭3 + 4 + 5 + ♭6 + 7, compared with the major scale).

This scale has a unique, exotic, Eastern sound to our Western ears, due to the large interval (an augmented second) between the sixth and seventh degrees of the scale.

The parallel minor

A parallel minor scale is one that shares its tonic with a major scale but not the same notes or key signature, for example C major and C minor.

EXERCISE 114

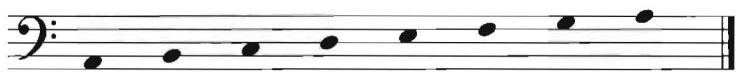


The parallel minor scale can take on any of the minor forms: natural, melodic, or harmonic. The principle works in reverse; every minor scale has a parallel major scale. Substituting major for minor and vice versa is called modal interchange.

18. MINOR SCALE HARMONY

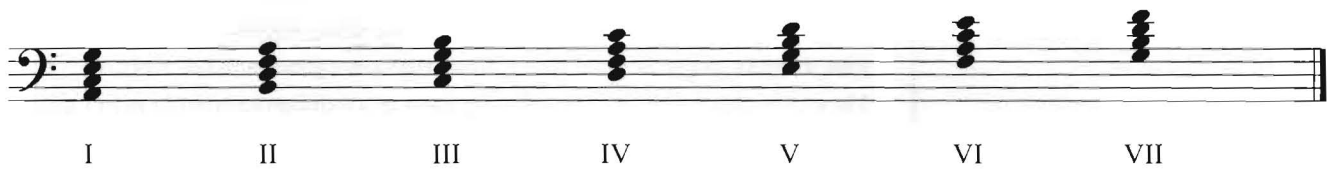
In the same way we harmonised the major scale, we can harmonise minor scales to analyse tunes written in minor keys. The methodology remains the same: first write out the minor scale (in this case, A natural minor – Exercise 115).

EXERCISE 115



Then add the chords to each scale degree. Let's go straight to seventh chords this time. The resulting harmony gives us these chords: I minor seventh, II minor seventh with a flattened fifth (half-diminished seventh), III major seventh, IV minor seventh, V minor seventh, VI major seventh, VII dominant seventh (Exercise 116).

EXERCISE 116



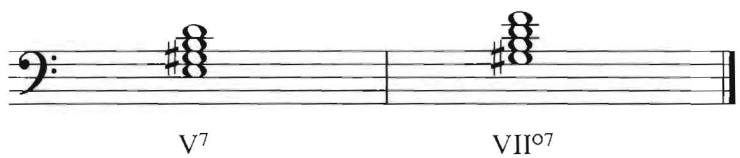
The pattern is the same as you find if you start harmonising on the sixth degree of a major scale.

This where the combination of music theory and practice takes an interesting angle. The V chord, a minor seventh, doesn't have the same effect of resolving (that is, returning to the I chord) that the dominant V chord does in a major scale. The answer? Move the theory to fit. What the ear tends to demand from a V chord is a dominant quality. To achieve that we need to turn that V chord into a dominant chord. That means raising its third by a semitone so it becomes a major third. In this case, G becomes G♯. Since the third of the V chord is also the seventh degree of the scale, the seventh also rises by a semitone. The resulting scale is the harmonic minor (see Minor Scales, p193).

This change also has an effect on the chord built on the VII degree of the scale. It is now a semitone higher and a diminished seventh chord rather than a dominant seventh chord. These harmonic alterations are shown at Exercise 117.

EXERCISE 117

CD TRACK **49**



One more result of raising the seventh of the scale by a semitone is that the III chord, a major seventh, should now have an augmented fifth. But in practice it tends to remain unaltered.

Our new harmony is thus: I minor seventh, II minor seventh with a flattened fifth, III major seventh, IV minor seventh, V dominant seventh, VI major seventh, VII diminished seventh. Finding our key centres still involves locating the V chord, only now the resolution may be to a I (minor seventh) chord.

A piece of music may contain key centres from both major and minor tonalities. With our V7 chord now part of the harmonisation, it pays to use the V chord to locate the key centre. A II V I progression in a minor key now has a half-diminished chord as the II chord, and the I chord is minor.

Sometimes lower-case roman numerals are used to indicate minor chords to distinguish them from major chords: ie, ii iii vi.

19. EAR TRAINING

"The bass player affects the harmony, the structure, and the dynamics of the song more than anyone else in the band, so you really must know what everyone is doing rather than just what *you* are doing." Words of wisdom, indeed, from Led Zeppelin's John Paul Jones.

While techniques, theory and reading are all important parts of general musicianship, it's usually agreed that the most important part is having a good ear. Nothing to do with lobe shape of course; when a musician is said to have a good ear it can mean many things. More often than not it simply means the ability of a musician to listen to what's going on around him and play without being self-indulgent. The bass player who listens intently to the drummer, vocalist, and other players, and then reacts in a manner that makes those players sound good is always the player with the best chance of making it in the music business. To an old hand this should (but not always) come naturally and be borne out by experience. To a newcomer, dealing with posture, equipment, discovering the notes, and then playing the right ones, it seems there is very little time to do any listening. This is a big mistake. Let's help out by seeing what the pros have to say on the matter and offering some practical advice.

Listening out

Dynamics are often forgotten in rehearsals and gigs. Try and listen first, before playing a bass part. Ask yourself some questions: is the drummer playing all his kit, or just a few select drums and cymbals? Is he hitting some harder than others, eg, medium attack on the snare but hard accented cymbal hits? Do the dynamics vary, eg, start soft and then get louder? And what about the vocalist? Are certain passages being dealt with more emotionally than others? Or is it full thrash from the word go?

Michael Rutherford, who held down the bass for Genesis and now with Mike and The Mechanics, emphasises the bass guitar's role: "If you haven't established the bass note [under a chord] you've got a choice of notes to use and it can give the song such a lift. Occasionally it's the opposite. The bass note gives such a firm sense of what the chord is that it can make the chord too strong ..."

One of the easiest and most effective bass parts in the world (rarely employed) is simply to do nothing. Not for the whole tune, although sometimes even that is appropriate, but maybe just for a verse, or a single line, or even just a bar. Actually, maybe just drop out for one beat. Listen to your favourite bands. Do you notice how they don't all play all the time? There's a reason for this; it makes the music more exciting, more dynamic. Andrew Levy, bassist with The Brand New Heavies recommends such an approach: "Always sit back – you can play the most amazing bassline with just two notes."

Training the ear

Ear training is a way of learning to hear what a note (pitch) will sound like before it is played. Just think how useful that could be. You're playing a riff and fancy changing a few notes, just to see how they sound. If you could hear them before you played them, you'd know how effective they would be. And what if the guitarist suddenly changes the song structure, having forgotten to tell you about the new special chord he's decided to throw in at the last minute. Wouldn't it be great if you could hear what that chord was and play

a suitable line to go with it straight away? Or maybe you've been asked to join a jam session, and bravely leap on stage (after nervously sweating it out for the last eight jam numbers while others played) when a tune you know is called. "Oh great, Hendrix's 'Purple Haze', I know that one, I rip on it," you think to yourself. Plugged in, amp knobs tweaked (nerves again, nothing to do with sound) and thank heavens for that chromatic tuner, eh? Let's go ... what's that? Drummer doesn't know 'Purple Haze'? Keyboard player wants to jam another tune? We've decided to play 'Cold Sweat'? I don't know it ... Who's that counting in, 1 2 3 4? Help. I'm in a cold sweat ..." Our ear-trained bassist falls silent for a bar or two, finds the key, nails the tune and gets asked to join the local hot funk act. Our untrained-ear bassist wiggles his jack, as if to imply a faulty cable ...

Relative and absolute

There are two types of pitch training. The first is to develop relative pitch. Upon hearing a given note, the player can sing (or hear in his head) any other pitch above or below that note. It means establishing the relation between two pitches after being given the identity of one. Imagine you are given the note name G, for example. If another note is played, say D, you can name the note D without playing it yourself. If no note name is given, the relative-pitch musician can still identify the interval, in this example a perfect fifth.

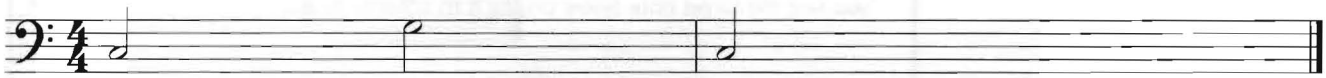
Some individuals are born with a special gift, absolute or perfect pitch. Any note can be played and named instantly without any other clues. It is an amazing thing to observe. Sitting in a room with my Bass Institute of Technology instructor, Lawrence Welk bassist Richard Maloof, I would turn my back to him and pick what I thought were the most abstract notes I could find: wide compound intervals, dissonant tones, the lot. But he named every single one. "E♭, G♯, A♭ ... a bit flat as well, that last one," he would say. And he was always right. There was a catch, though. Maloof told me that he couldn't stand to hear any music that was slightly out of tune; it made it hard for him sometimes even to play under those circumstances.

There are also some who claim you can learn the skill of perfect pitch. David-Lucas Burge has run an ad for this in music magazines for as long as I can remember. I've yet to meet anyone who has learnt perfect pitch, though; they have always been born with it. But relative pitch can definitely be learnt, and so is the best place to start.

To develop relative pitch, you can try singing sounds that you have become familiar with: the major scale for example. Then try singing each individual interval from the root (see Intervals, p151). Start with the diatonic intervals and then try chromatic intervals. Try this simple test (Exercise 118).

EXERCISE 118

CD TRACK **50**



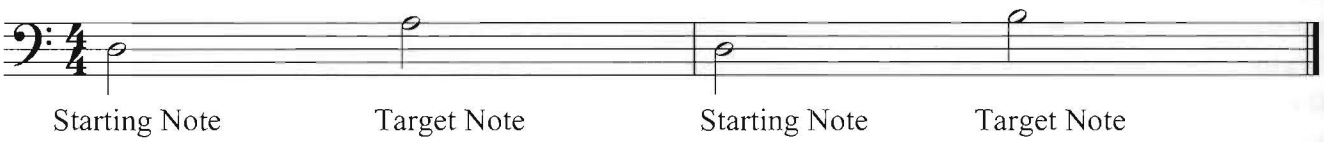
Starting Note Target Note Starting Note Can you hear the target note?

Play a C on the A-string. Now look at (but don't play) the G on the D-string. Can you hear the pitch before you play it? To start the ear training process, sing or play a major

scale starting from the C. G is the fifth note of the scale, a perfect fifth. Now play just the C again, and try and sing (or hear) the G. It should be easier now, because you've made yourself more familiar with the sound of that interval. So make it a little more challenging by playing Exercise 119 below, which starts on a new root note, D.

CD TRACK **50**

EXERCISE 119

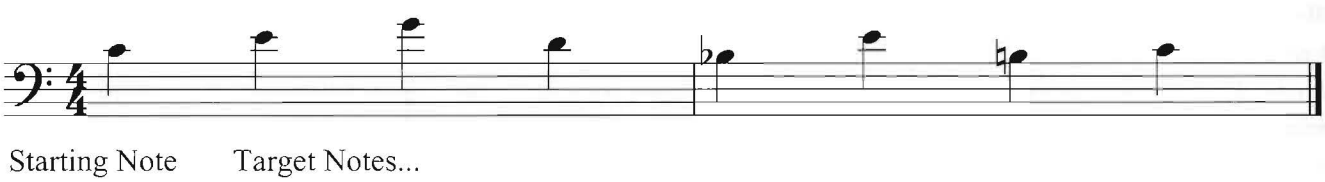


Try and hear the A before playing it. Some players help themselves by remembering musical motifs that incorporate the intervals. The 'Star Wars' theme has a perfect fifth between its first and second notes – go on, try it. The second example here is a leap of a major sixth, which is the start of 'My Bonnie Lies over the Ocean'. Learning those examples can help you sing intervals until they become second nature. Like all musical techniques, this skill comes with practice and time.

More practice

All the intervals in Exercise 120 are played on one string, the G-string. Play the root C and then sing (or hum) the next note (E). Hold that singing note and play the E on your bass. Were you spot on, close, or miles out? If the latter, go back to exercise 118! If you hit the right note, sing the next note (G) and continue as above. There are some difficult intervals in there, so persevere.

EXERCISE 120



To take this even further, play the starting note and then sing the next note as before, but slide to the target note without looking at the fretboard. It's very easy to cheat here but obviously that defeats the whole exercise. What players do is play the first note, then slide to the target note, and then sing it after they've heard themselves play it. Make sure you sing the target note *before* playing it to confirm your accuracy.

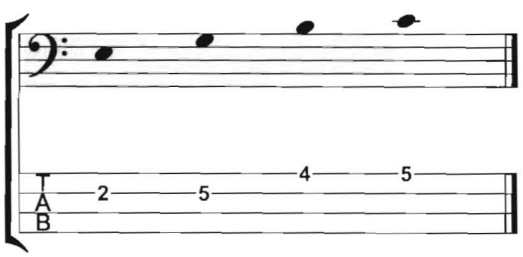
20. INVERSIONS

Whilst triads and seventh chords are commonly voiced or performed from the root note upwards, you can also invert them. That means playing notes other than the root first in a bassline or placing them at the bottom of the chord. Thus the classic root/third/fifth pattern might (and let's emphasize 'might') be played fifth/root/third. How does this work? In root position, the chord's root (the note that gives it its name) is also the bottom note. A first inversion chord places the third of the chord in the bass; the tonic remains in the chord, but it is placed above or played after the root. In a second inversion chord the fifth of the chord becomes the bottom note, and in a third inversion the seventh is played as the lowest note.

Exercises 121 to 124 illustrate the inversions.

EXERCISE 121

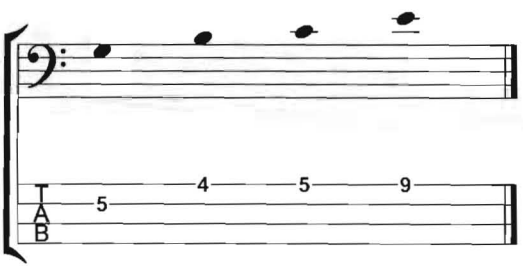
C major seventh, first inversion:



CD TRACK **51**

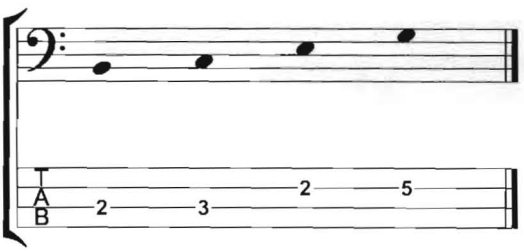
EXERCISE 122

C major seventh, second inversion:



EXERCISE 123

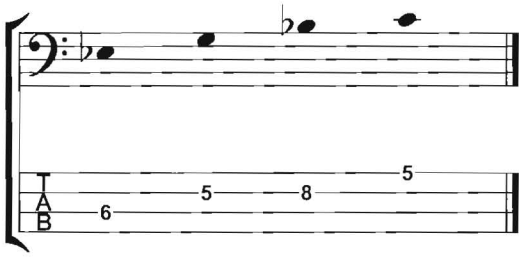
C major seventh, third inversion:



CD TRACK 52

EXERCISE 124

C minor seventh, first inversion:



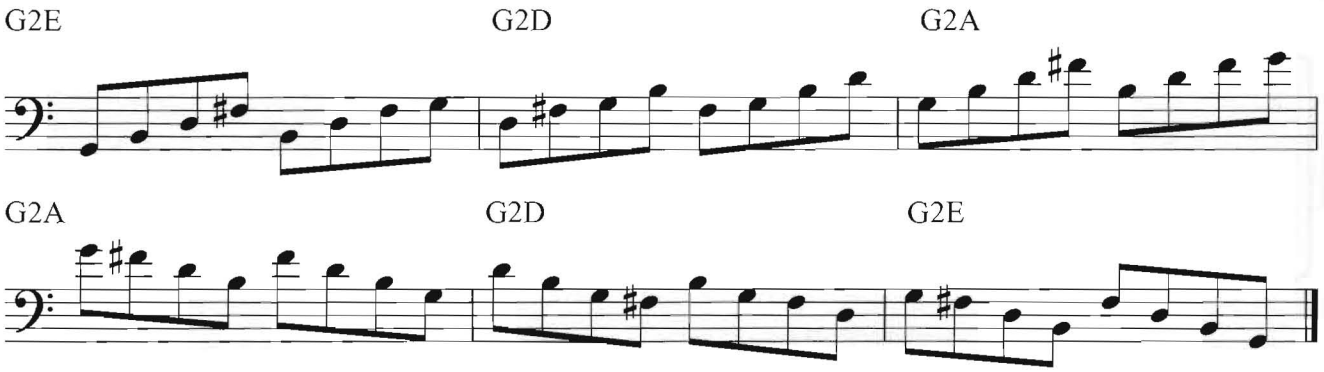
Inversion exercises

Exercises 125 to 127 illustrate chord inversions, help you shift across the neck and take you from low areas to high on the instrument. These exercises can be applied to any chord type. Here we use major, minor, and dominant shapes.

When inverting the chord, be aware of your key centre. One method is to fix your hand position in reference to the key. The following method is taught by Gary Willis, the fretless bass player and clinician. Position G2E refers to the key of G, second finger on the E-string. G2D will refer to the key of *G*, second finger on the D-string. One can use fret positions, but when inverting chords, it is very easy to fall into habits of regular position playing and lose sight of what key you are in.

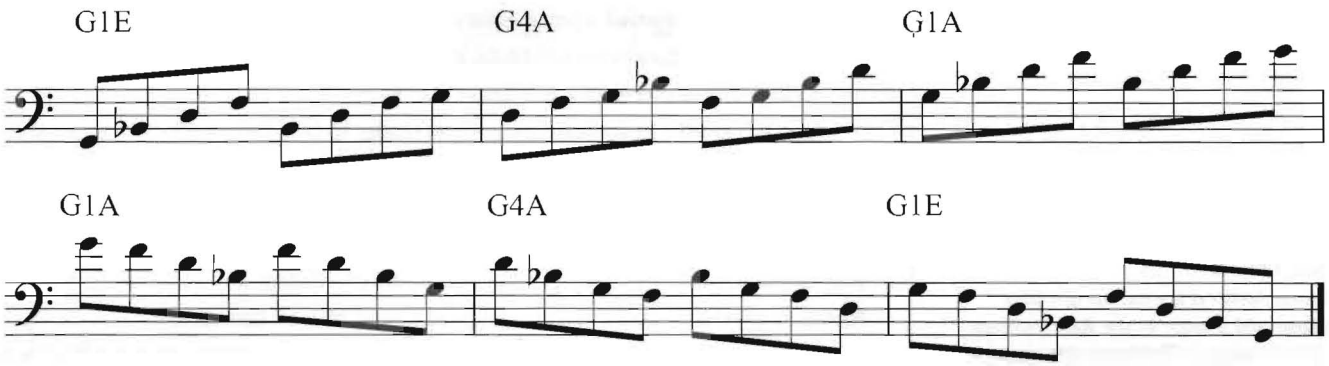
EXERCISE 125

Gmaj7 in root position, first, second, and third inversions:



EXERCISE 126

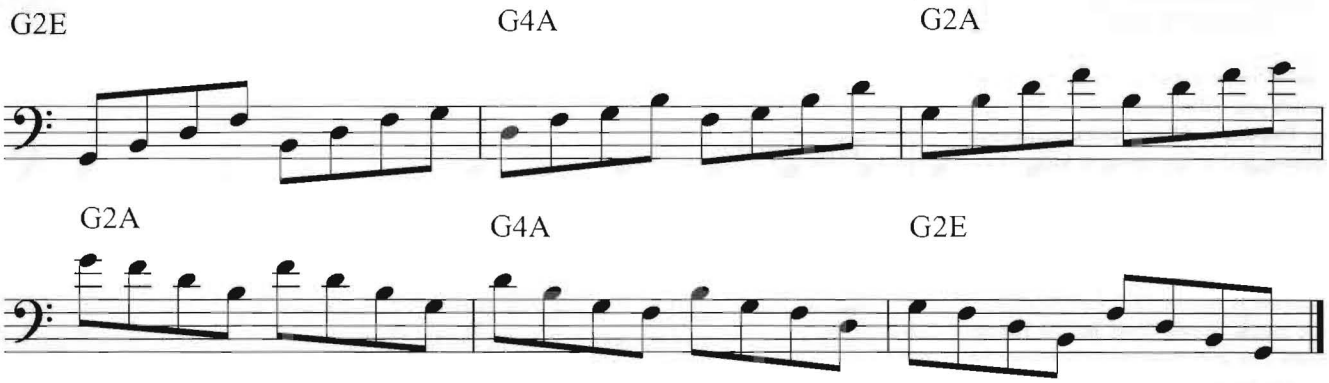
Gmin7 in root position, first, second, and third inversions:



EXERCISE 127

CD TRACK 53

G7 in root position, first, second, and third inversions:



Note: there is no tab for this exercise. It's time to start getting serious. Work out your own fingerings for this exercise. Even listening to the CD and learning the exercises by ear will be more beneficial than relying on tab. Time to look into Reading Music.

21. READING MUSIC

Sight reading is one of the great pleasures of being a musician. The ability to pick up a piece of music and read it through means many things to many bass players. For some it is an essential part of their job; studio sessions, jingles, and casual gigs all require an ability to sight-read (or be the world's greatest bluffer). For others, sight reading may only consist of an ability to read through a chart and improvise over chord changes.

Why read?

Many players choose not to read, and I'm not going to lecture on why that may not be a good thing. With age and experience I realise that the most important thing in being a musician is to enjoy yourself; don't let anyone else tell you otherwise.

But when I couldn't read music, I wasn't enjoying my bass playing as much as I might

have been. I made it my mission to get to grips with the written language of the bass guitar: the dots.

I'm glad I did. I earned a better salary and played some great music because I could read notation. Tablature is no substitute. It is merely a guide to reading, and doesn't offer two further crucial pieces of information; the rhythm and your location in a chart.

You can't expect to go from being a non-reader to being a fully fledged reader at the flick of a switch. Like the art of improvising a solo, the skill develops slowly over time. This means there may be a long period when reading is difficult and you feel like a learner all over again. This is normal and to be expected. You'll soon know what reading challenges you can and can't accept. The first steps towards reading are covered in the Basic Notation (p141) chapter, above, so you might want to look back at that.

The most important part of reading is to not get lost in a score. Let me explain why. If you know exactly where you are in the score, you can play a simplified version of the written part and you'll know when to start, stop, and end the piece. These are all good things. If you play the intro note-perfect, but then get lost, you'll be in trouble. At best the rest of your performance will be silent or, worse, you will play the wrong part. Of course, as you learn to develop sight-reading skills, you may not at first be able to play every single section of a score. That's OK: it's part of the learning process.

The foot

For most people, the foot plays an important part both in playing music and in reading. We use it to tap out the beat that we are following: the quarter-note (crotchet) in a piece of music written in 4/4. That sets the tempo and provides the regular pulse or foundation against which we read the changing rhythms of the music. This standard method feels natural, is easy to grasp and is the method that most musicians in all fields learn and use. There is another approach, however: see The Putter Smith Method (left).

Exercise 128 is just about rhythm. Use your foot to keep time, while clapping the notated rhythms, singing them, or playing them on your bass. The foot movements must be positive, not sloppy, and should 'lock in' with the beats. Remember to 'play' the rests. You will note that your foot is off the ground on the off-beats, which will help you deal with the latter part of the exercise, where eighth-notes are included.

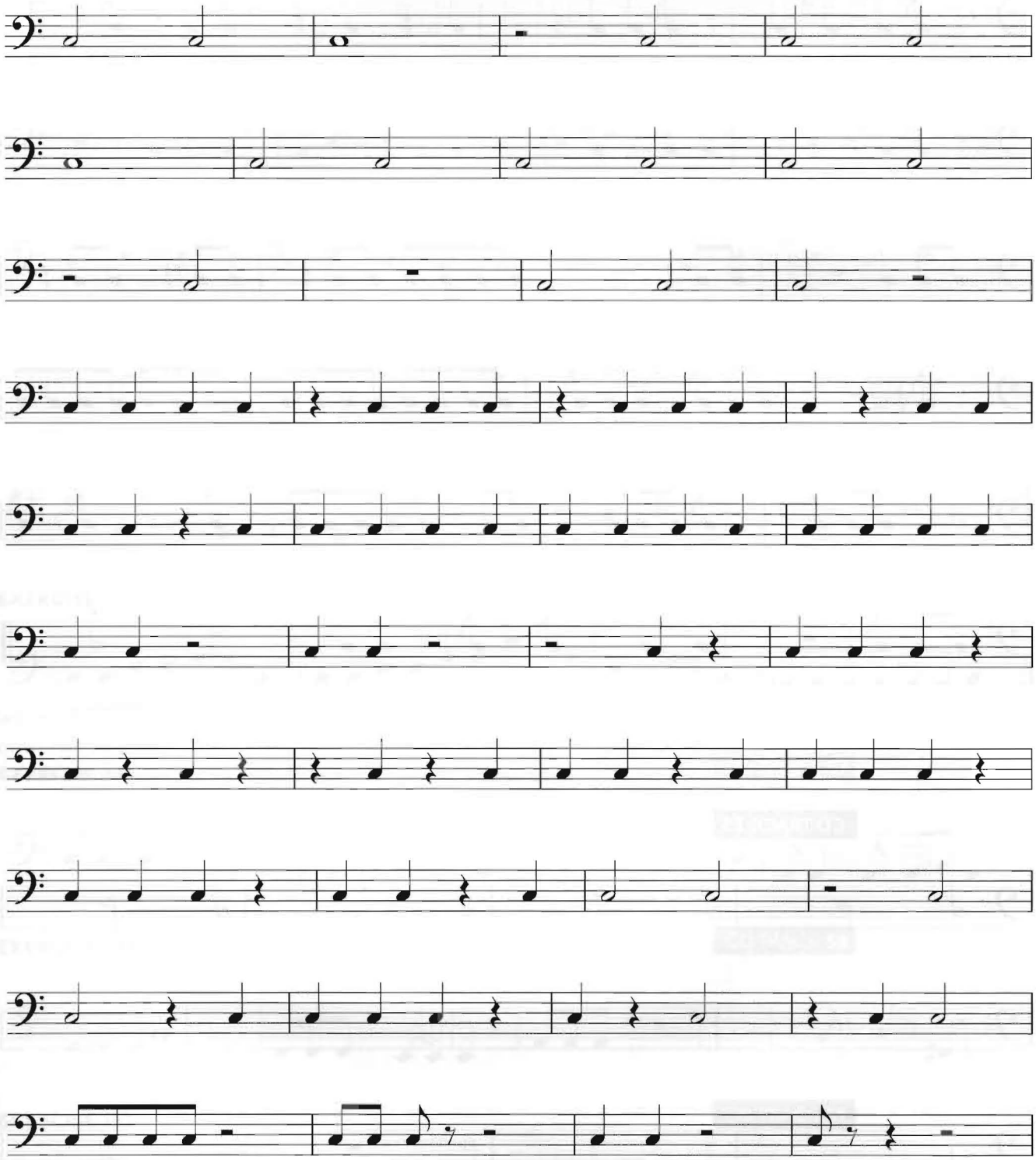
Note that the counting syllables we used in the Basic Notation chapter (p141) are not included here: you should understand how to work out these rhythms by now, but go back if you need help. The exercise is included on the CD, but don't just play along with the music: work it out, play it, and use the recording to check what you're doing.

THE PUTTER SMITH METHOD

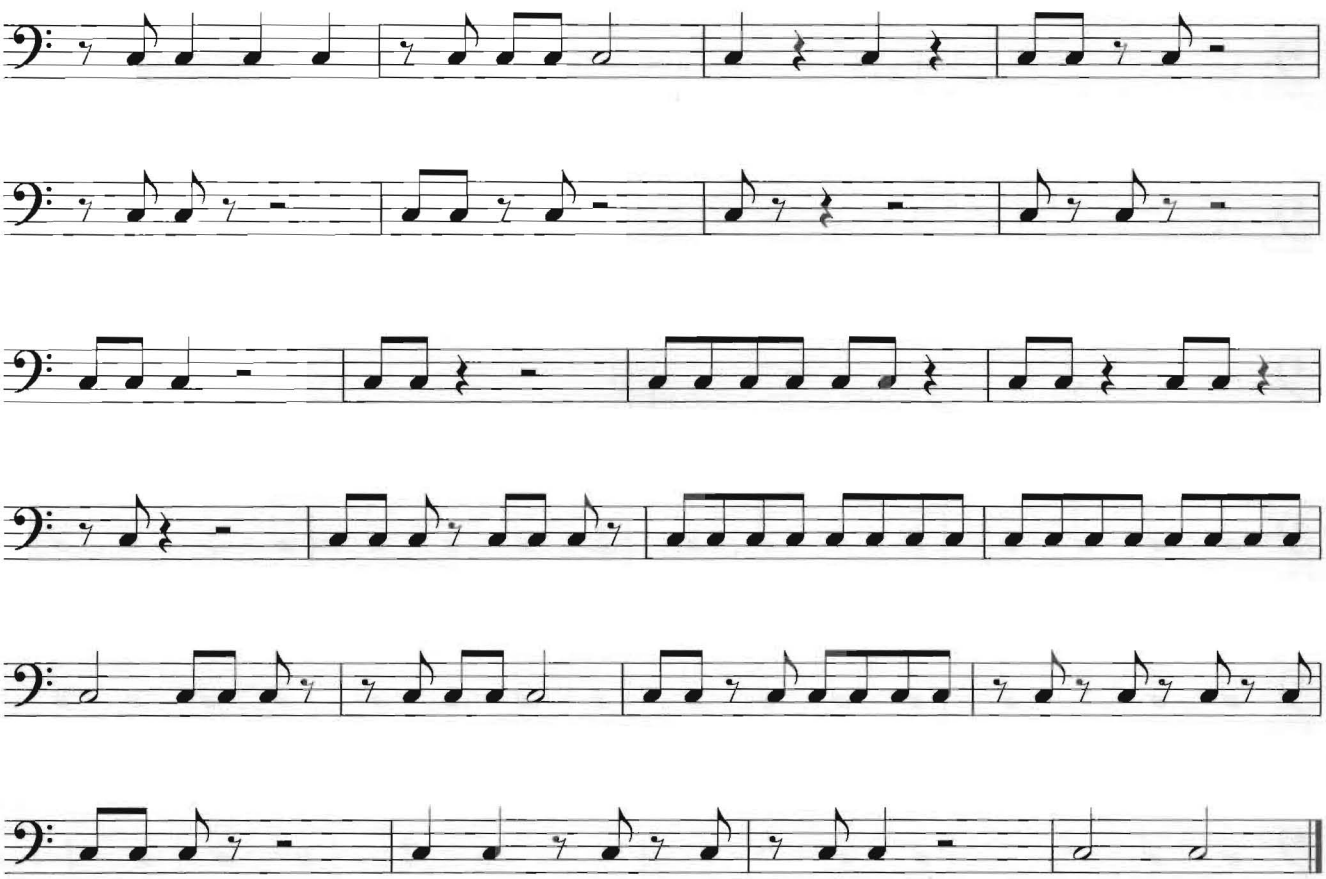
Putter Smith is a great upright bass player and a tutor at the Bass Institute of Technology in California. (As an actor, incidentally, he is also one of the villains in a famous James Bond movie.) He teaches a system that takes the use of the foot to a higher level. It uses the upward movement (or upstroke) of the foot to emphasise specific beats. In essence, when tapping the foot, your heel remains the pivot point from which you either tap down or lift back up. The way it differs from normal foot-tapping is that the upwards foot movement is precise and conscious and moves to stay in time with the underlying pulse. The up-foot movement 'triggers' the beat or rest. In our first reading example (Exercise 128), for instance, the foot is tapped down on the strong beats, one and three, and raised on the weaker beats, two and four. So we tap down (one), up (two) down (three) up (four) and repeat... This allows you to locate more precisely your part in a score, especially at fast tempos. There are disadvantages to this method, the biggest of which is overcoming your own resistance to using it. It also requires that you use different movements depending on the underlying pulse (eights or sixteenths – sometimes referred to as the 'grid') and time signature; 3/4 for example has one down beat, a rest stroke, and then an upbeat. For 'odd metre' music, for instance 5/4 or 7/4, you have to use some combination of the 4/4 and 3/4 patterns. I too was a sceptic until I was persuaded by Putter to carry it through. Now it's the only method I use when teaching sight reading on the bass guitar. Ultimately practice and experience is what will get you through the sight reading struggle, but you might try this method. But you will have to give it a good few months before you decide whether it is working for you.

CD TRACK **54**

EXERCISE 128



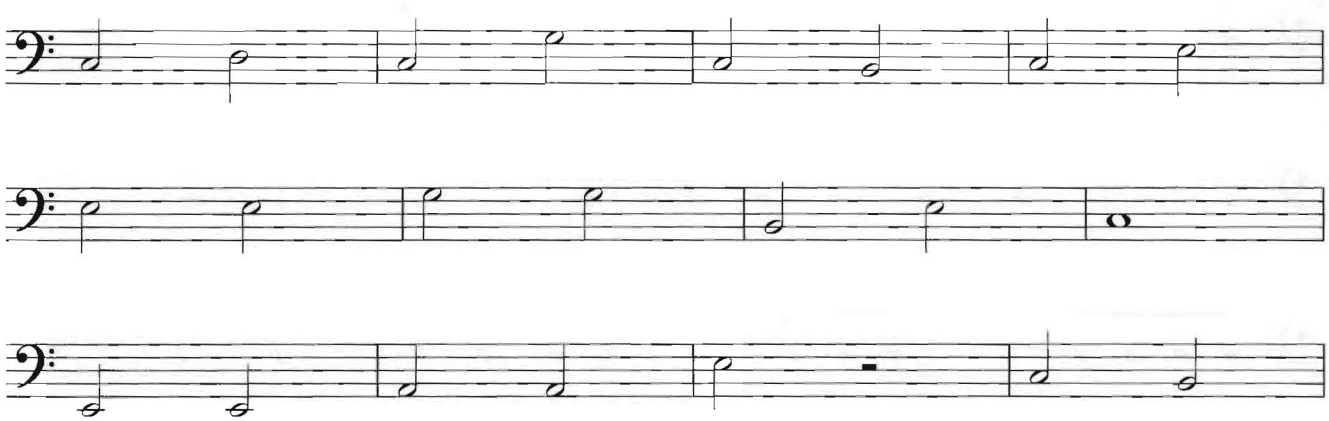
Exercise 128 *continued*



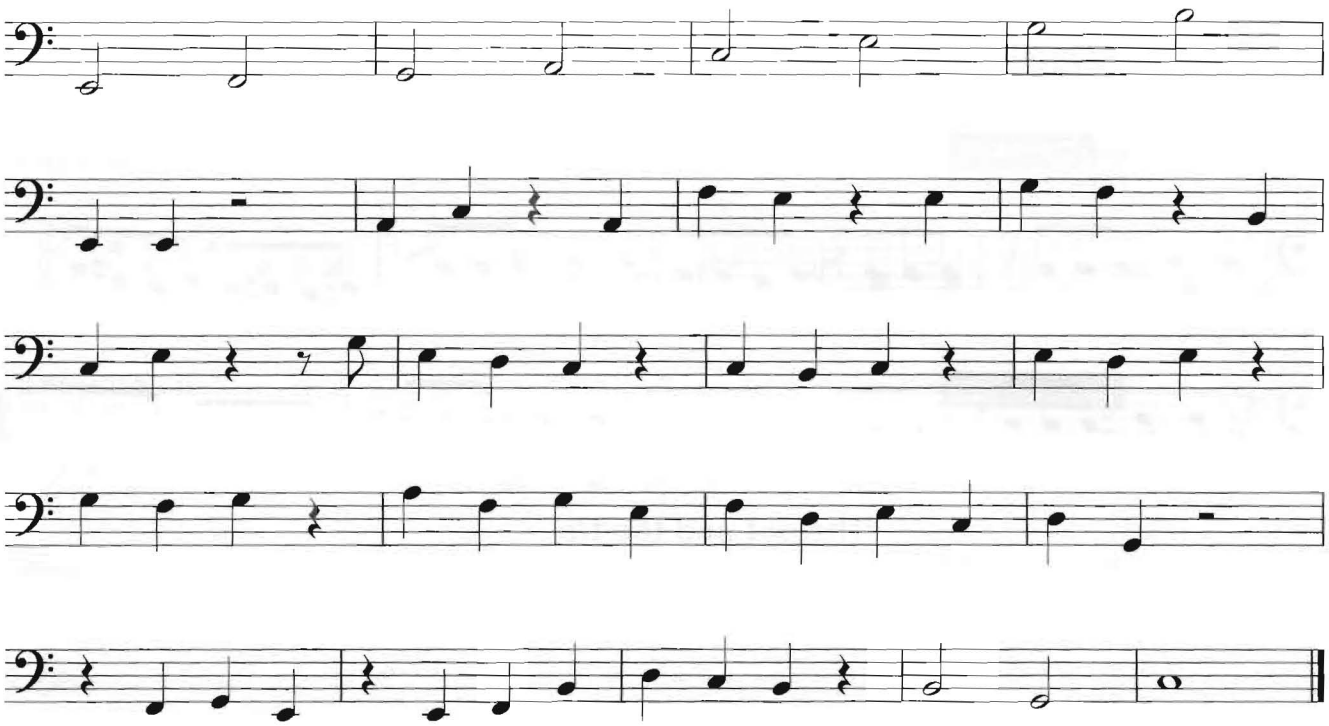
Exercises 129 to 133 add pitched notes, starting with half-notes and whole-notes and moving up to eighth-notes. You will need to play them on your bass. Again, start slowly and make sure you consciously register the rests. All these exercises are on the CD.

CD TRACK **55**

EXERCISE 129

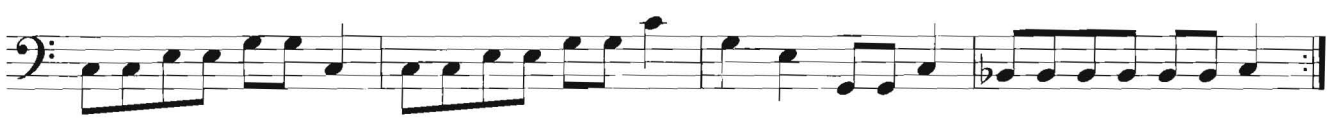


Exercise 129 *Continued*



EXERCISE 130

CD TRACK **56**



EXERCISE 131

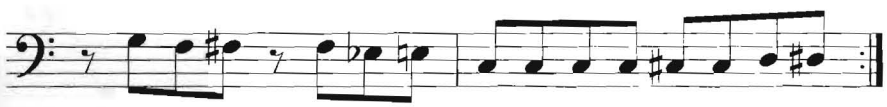
CD TRACK **57**

EXERCISE 132

CD TRACK **58**

EXERCISE 133

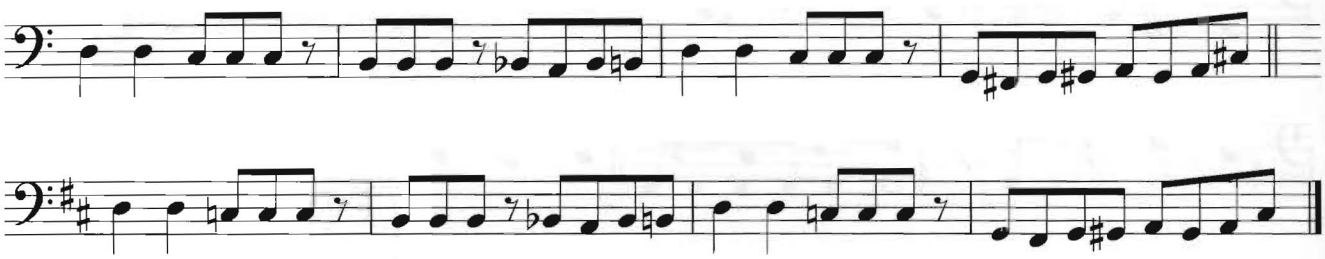
CD TRACK **59**



Exercises 134 and 135 are the same bassline, both in sound and fingering. But the notes are written in two different ways. The first time the notation is written in the key of C, with accidentals (see p173). The second time it is written in the key of D, again with accidentals. Study the accidentals carefully to make sure you understand the rules.

CD TRACK 60

EXERCISES 134 AND 135

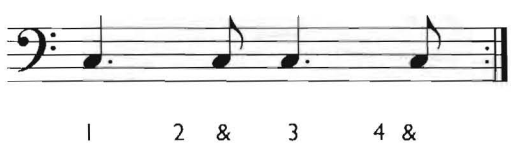


The dot and the tie

Sometimes we need to lengthen a note to a value not covered by our basic notation. The dot and the tie achieve this for us. Adding a dot to a note increases its length by 50 per cent. In other words, a dotted quarter-note lasts as long as a quarter-note and an eighth-note combined. The dot works within a bar, but cannot be used across bars. You can also add dots to rests, to increase their length in the same way. One of the most popular of all bass riffs is a dotted rhythm; see Exercise 136, below.

CD TRACK 61

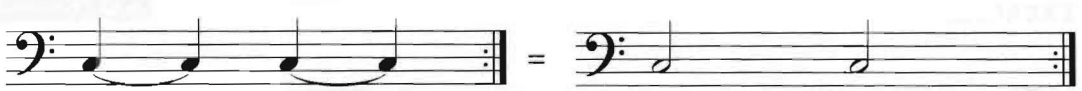
EXERCISE 136



The tie (below) joins two or more notes of the same pitch. The second and subsequent notes aren't played but are held for the value of the notes tied together. Two quarter-notes tied together equal a half-note, as in Exercise 137 below. Rests cannot be tied.

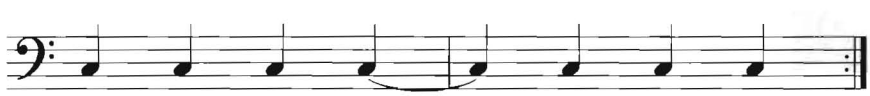
CD TRACK 62

EXERCISE 137 **EXERCISE 138**



Why not just use a half-note? Well, as in Exercise 139, you might want to hold a note across two bars.

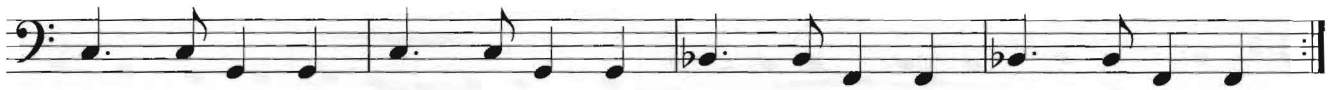
EXERCISE 139



Exercises 140 to 147 demonstrate how dots and ties can work together to represent more complex rhythms. Exercises 142a and 142b have a Latin flavour. Play each separately to get a feel and then combine them for a groove that glides between the changes.

EXERCISE 140

CD TRACK 63



EXERCISE 141

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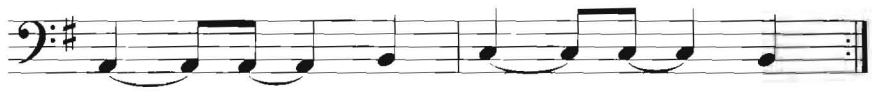

EXERCISE 142A

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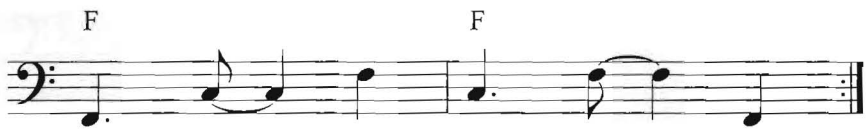

EXERCISE 142B

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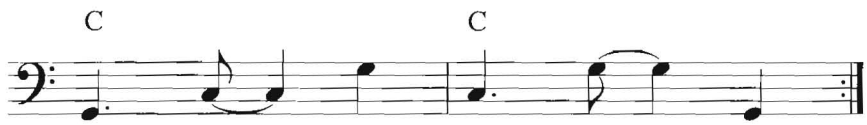

EXERCISE 143

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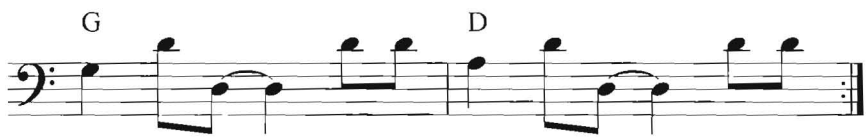

EXERCISE 144

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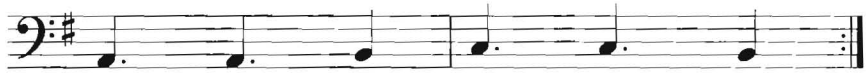
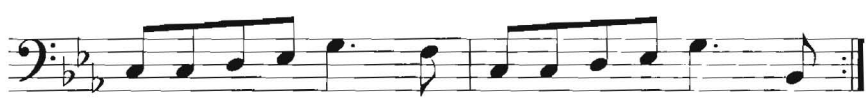


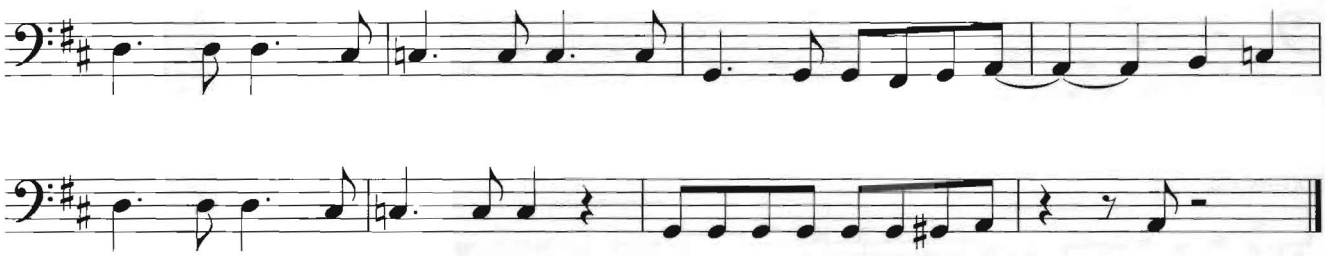
EXERCISE 145



EXERCISE 146

CD TRACK **68**

EXERCISE 147

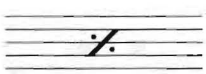


Syncopation

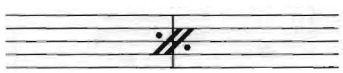
Syncopated rhythms place accented or strong notes on the offbeat, meaning between the main beats of the bar; where the pulse isn't normally so strong. Putting melodically or rhythmically important notes on the offbeat can create an interesting bassline. Cream's 'Sunshine of Your Love', played by Jack Bruce, is a classic example of a syncopated or offbeat rhythm. Exercise 148 incorporates a syncopated rhythm within a short tune.

Form

Although occasionally you will be required to read only a few bars of music, normally you will be reading a chart or a score, which can be anything from a single page to a complete book of music. Although at first sight it appears that Exercise 148 is just eight or nine bars long, there are form instructions within the music telling you to repeat sections of it. An oblique stroke with dots either side, for example, instructs you to repeat the previous bar of music:



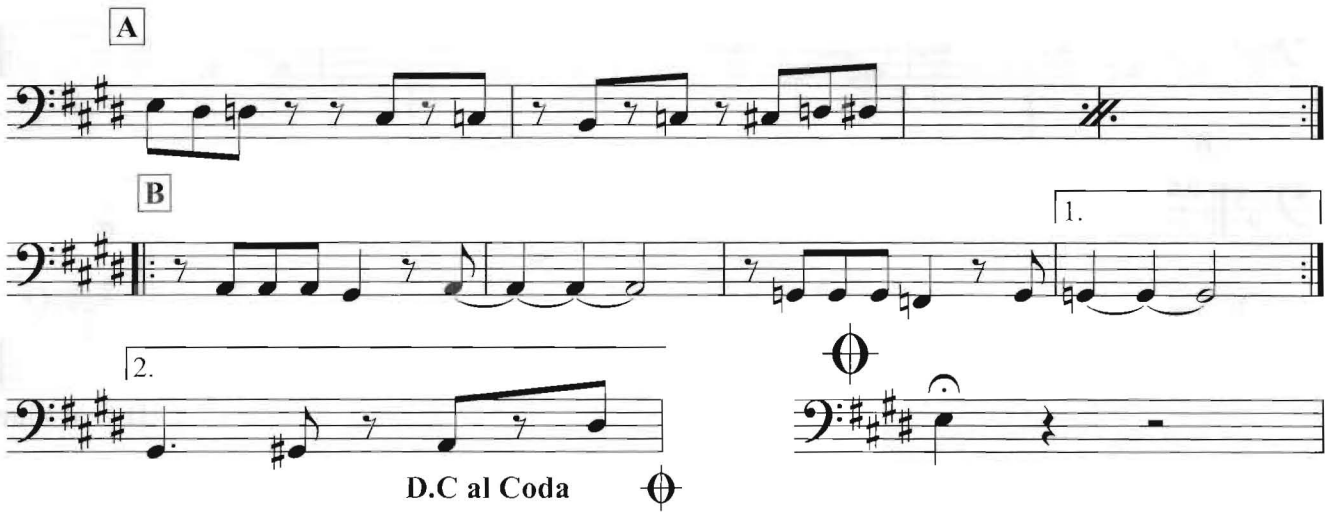
But when it is placed across two bars, with double oblique lines, it means to repeat the previous two bars of music. You can see this at bar three of Exercise 148.



A double bar line and a pair of dots within the stave (a repeat sign) means the whole section of the music has to be repeated:

In this piece, the repeat sign indicates that section A is played twice. Then section B is played twice; but it has instructions for two different endings. The first time through the first ending is used. Then we return to the beginning of section B, play the first three bars of the section, but this time skip the fourth bar and play the second ending instead.

EXERCISE 148



But there's more... The instruction D.C. al Coda is an abbreviation in Latin for Da Capo (from the beginning) al Coda (to the coda bar of the music). You make the leap to the coda bar when you see the coda sign, which looks like this:

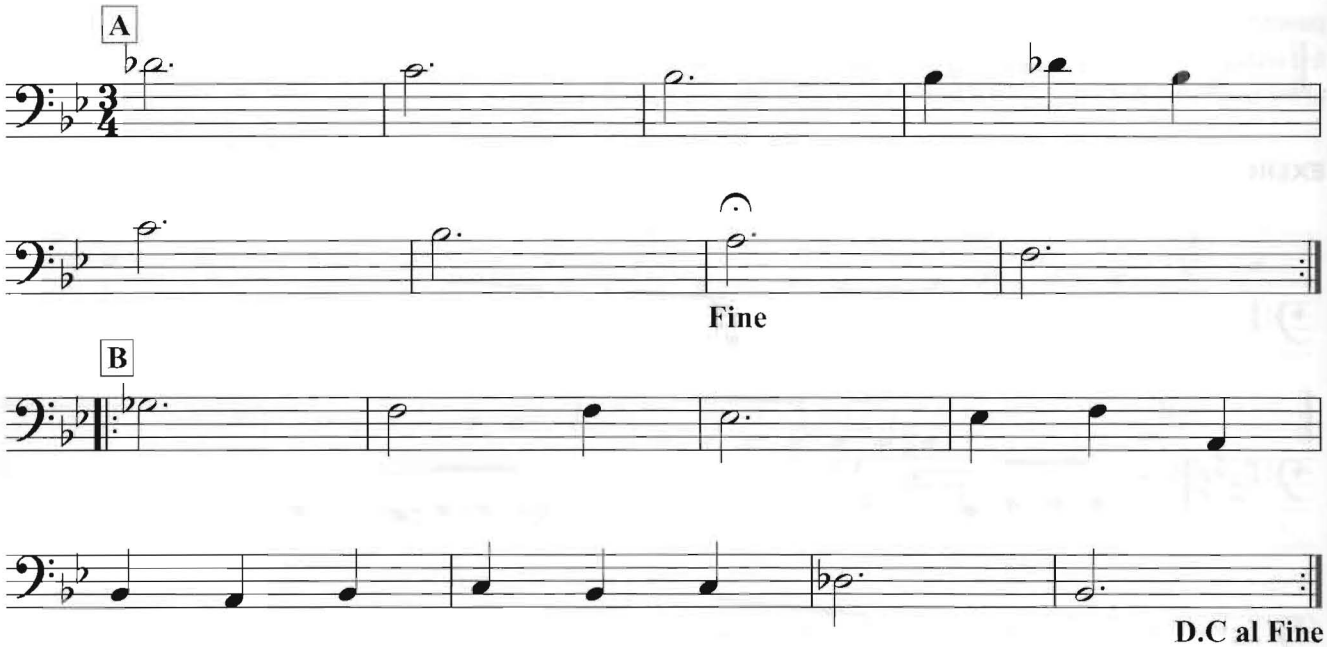
In this case D.C. al Coda tells you to go back to the beginning of A and play the piece through again, including all the repeats. It results in a second performance of the whole 16 bars of music, plus the one-bar coda at the end.

Feeling three

Exercise 149 is in 3/4 time. As was explained in the chapter on Basic Notation (p141), to read in 3/4 you tap your foot in groups of three rather than four. If you are using odd metres (5/4, 7/4, etc) you can count in fives, sevens and so on, although many find that those metres naturally fall into groups of twos, threes, and fours. It is important to count odd-metre bars carefully, especially when an odd-metre bar appears in the middle of a piece of 4/4 or 3/4 music.

More form instructions have been added. This time you have to D.C. al Fine, meaning "go back to the beginning and continue to the word Fine" (which means 'end'). In this case the word Fine is accompanied by a fermata sign, which indicates the note is held beyond its normal written duration: this sign is often called the 'bird's-eye', for obvious reasons. So the final sequence is: play A twice, play B twice, then return to A and play up to the Fine in bar seven. This kind of thing can be tricky, so you need to stay alert.

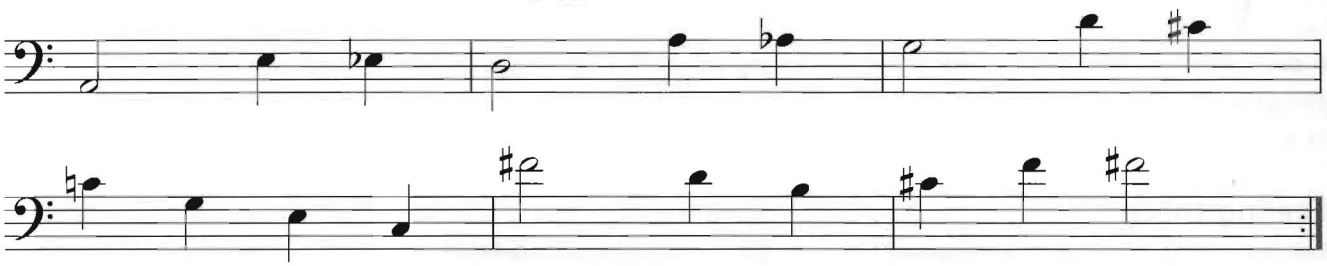
EXERCISE 149



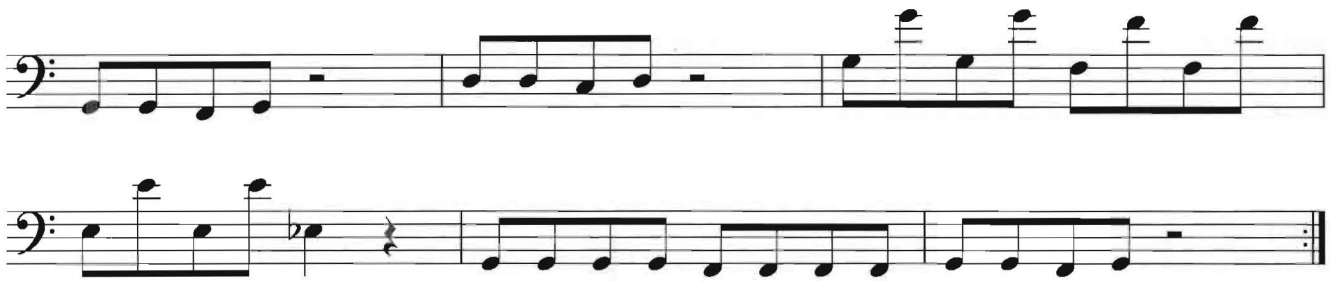
Shifting

As you improve your reading abilities you'll soon discover that only the simplest charts allow you to stay in one position, even when employing the one finger per fret method. Shifting is often necessary, and that's why this book has given so much attention to it. Exercises 150 to 152 incorporate basslines that require a shift.

EXERCISE 150

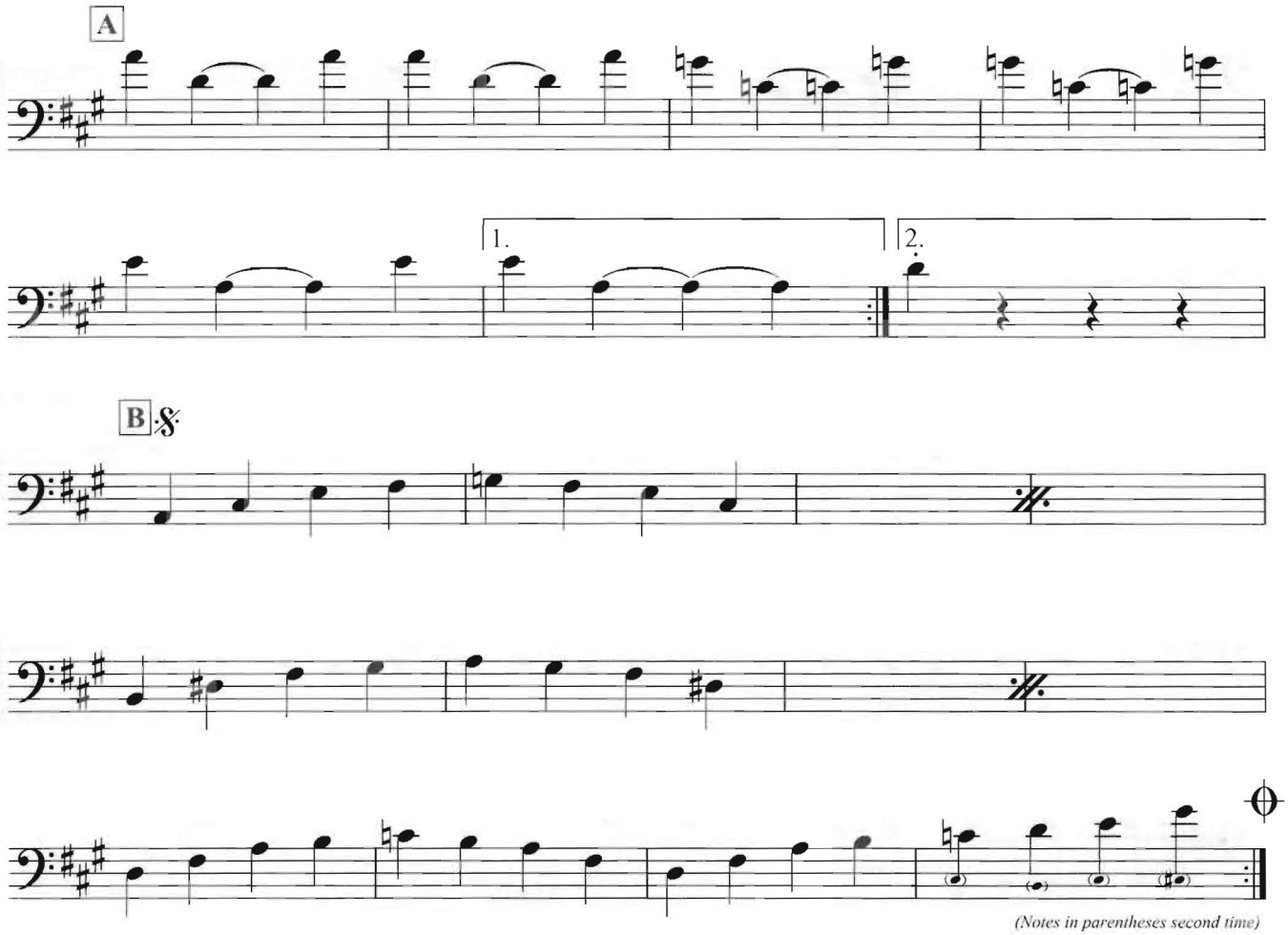


EXERCISE 151

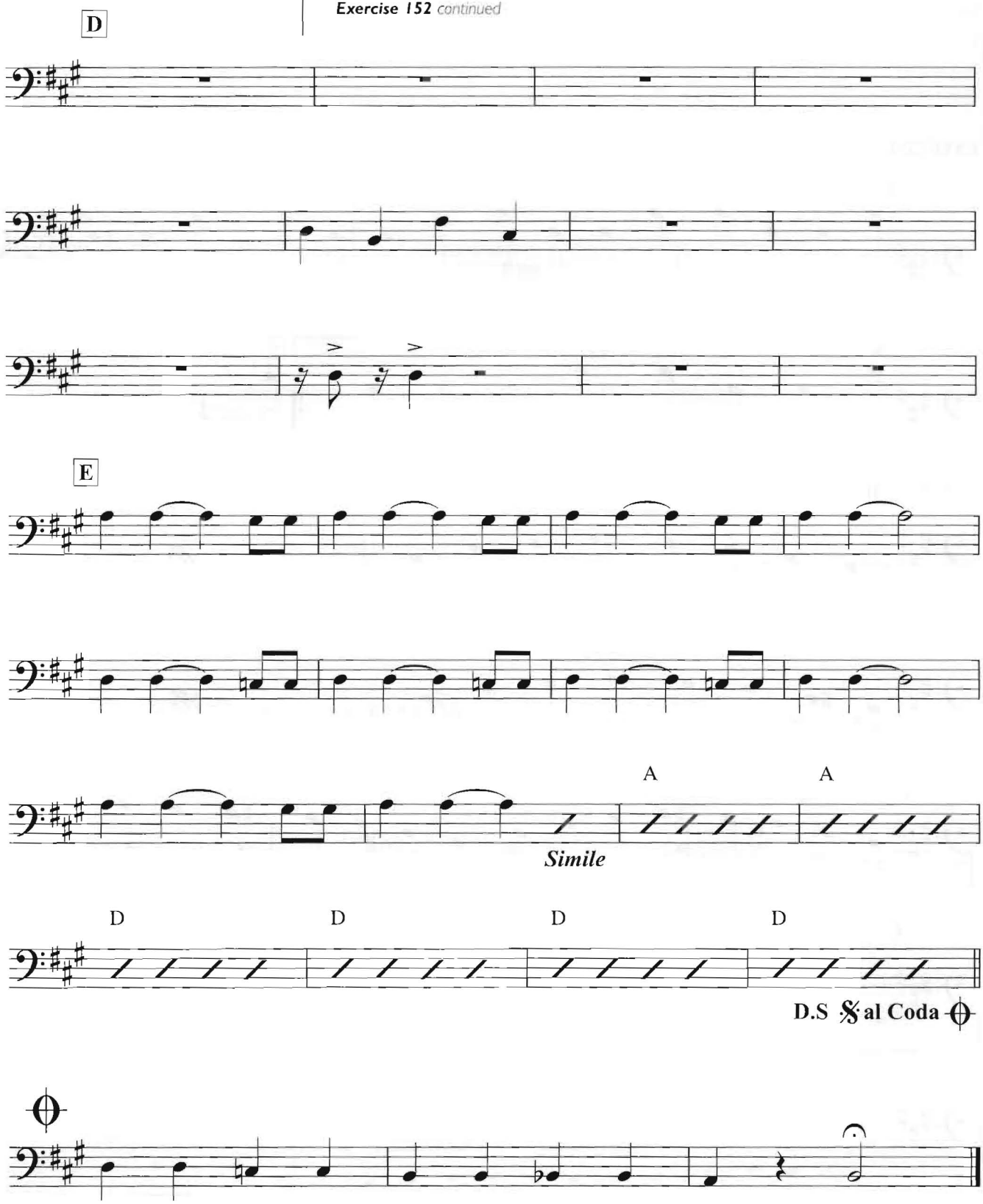


Exercise 152 is a complex chart, incorporating silences, odd rhythms, and simile passages, which means you carry on playing "in the same way". It will be a challenge to read and play accurately, but it is not untypical of the charts you will encounter as a working musician.

EXERCISE 152



Exercise 152 *continued*



The chart (Exercise 152) includes a new instruction, D.S. This stands for Dal Segno (from the sign). That means you go back to the sign, rather than to the very beginning. The further instruction al Coda tells you that when you reach the coda sign (at the beginning of bar seven) you must go to the coda, shown at the end of the chart.

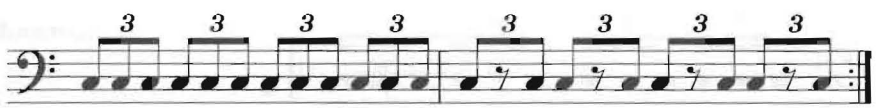
Note the instruction at the end of bar 47: Simile. This means you continue the bassline in a similar way, but small variations to the line may get an approving nod or frowns of disapproval, depending on the bandleader.

Triplets and swing

So far in this section we have grouped our notes into sub-divisions of two. The triplet subdivides the beat into groups of three: one-and-a, two-and-a, etc. When you're playing triplets in 4/4 time for example, each click of the metronome is still worth a quarter-note, but each click now receives three equally spaced eighth-note beats. One of the most common feels is swing, a triplet-based rhythm used in blues, jazz, and many other musical forms. In swing feel, the middle triplet in a group of three is replaced by a rest. The resulting rhythm is shown at exercise 153.

EXERCISE 153

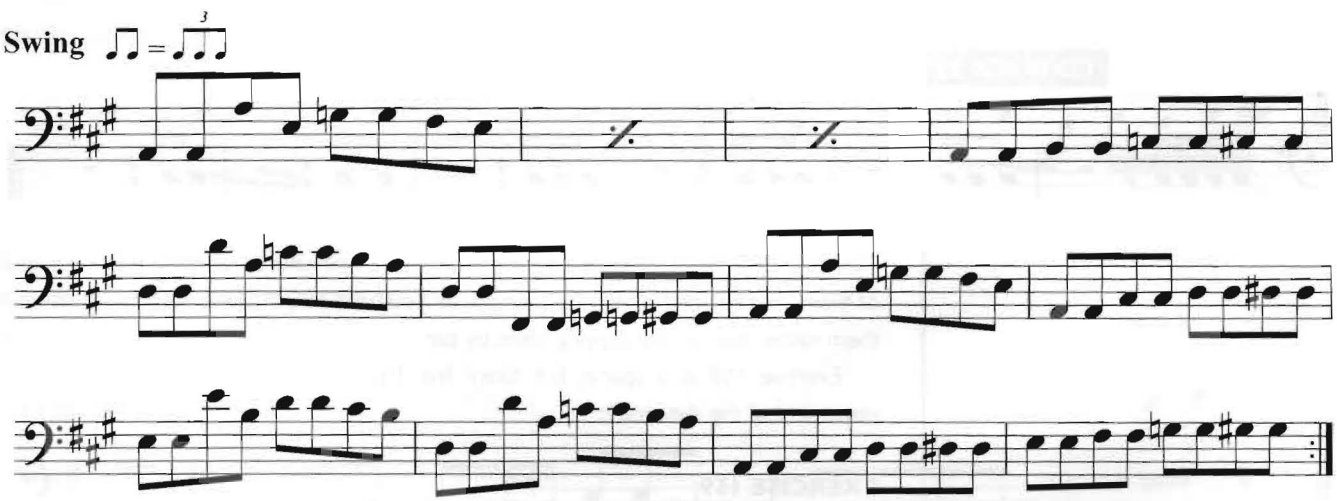
CD TRACK **69**



Sometimes a piece of music will be written in 'straight' eighths, but with an instruction to perform it in a swing or triplet style, as shown in Exercise 154

EXERCISE 154

CD TRACK **70**

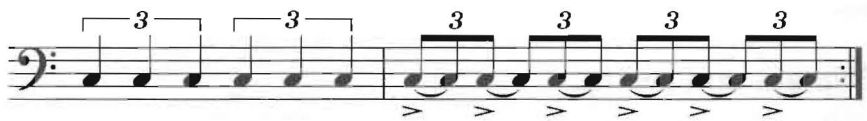


More triplets

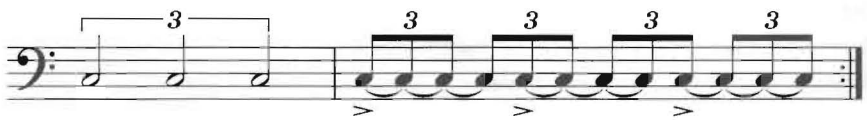
Quarter-note, half-note and sixteenth-note rhythms can also be subdivided into triplets. The sixteenth-note triplet feel is common in hip-hop music for example. Exercises 155 to 157 show how to interpret these rhythms.

CD TRACK 71

EXERCISE 155



EXERCISE 156



EXERCISE 157

Sixteenth-notes

Sixteenth-note rhythms do add pressure to the sight reading bassist! The popular term among session musicians for pages of dots scattered with complex rhythms is, ahem, "flyshit". More often, however, the patterns are simple funk-based rhythms that repeat.

Exercise 158 shows several ways of grouping sixteenths to cover a quarter-note.

CD TRACK 72

EXERCISE 158

Here are some typical sixteenth-note grooves you might have to read on a session. Some of them are recorded on the CD, but not all: you need to persevere with trying to read them rather than simply copying them by ear.

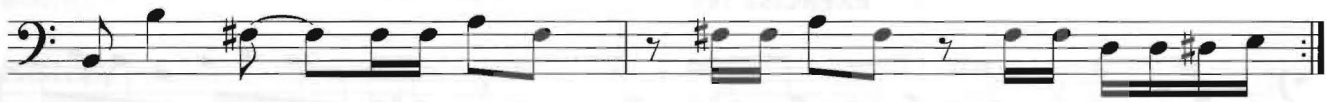
Exercise 159 is a sparse but funky line. Pay attention to the note length and placement of the sixteenths.

EXERCISE 159

Exercise 160 is a James Brown style funk groove, where sixteenths and eighths predominate the groove.

CD TRACK 73

EXERCISE 160

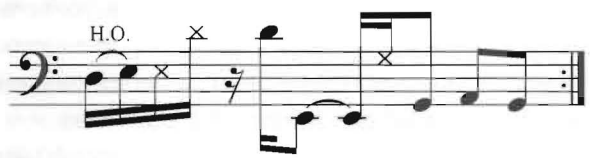


Exercise 161 is an R&B style line, similar to the style of Jerry Jemmott, who has played with Aretha Franklin, B.B. King, Wilson Pickett, King Curtis, and many others.

EXERCISE 161

Exercise 162 is a slap based line incorporating hammer-ons. It works well swung with a sixteenth-note triplet feel.

EXERCISE 162



Exercise 163 has a Motown flavour, with ties and syncopated beats throughout.

CD TRACK 74

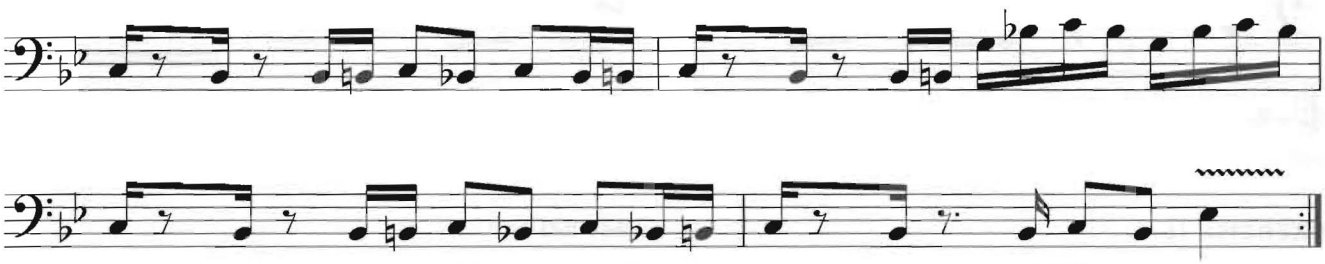
EXERCISE 163

Exercise 164 incorporates ties and sixteenths, but the main task is the movement from the very lowest notes on the fretboard to the high D, which needs to be executed cleanly and precisely.

EXERCISE 164

Exercise 165 is a fingerstyle funk line. Play the sixteenths short and sharp. The eighths can be a little shorter too. The last E is a chance to add a trill or some vibrato to spice up the line.

EXERCISE 165



Sight-reading tips

Sight reading is a skill that requires regular practice; but that's true of all aspects of playing an instrument proficiently, so it's no big deal. Don't talk yourself into viewing it as a difficult task. Practise a little every day if possible.

Make sure you have a good music stand. Fold-up designs are transportable but often have little capacity for dealing with real world charts that can spread across several pages. I find that a solid design, although more cumbersome, is much better. Trust me, you'll only allow your music to fall off your stand once in a professional situation. A clip, magnetic weight (presuming you have a metal stand), or other holding device can secure the pages to the stand; but make sure you can still turn the pages if page turns are involved.

A portable light is a useful accessory for a music stand. I find K&M Music Stand Light products to be sturdy enough for road use.

Be comfortable and be prepared. Sight-reading can get tense at times, so your stand, music, and equipment should all be well prepared. You don't want to be thinking about that faulty cable just before that tricky triplet-rhythm upper-octave bass part (with all other instruments tacet, meaning silent). This is of course a different situation to faking a faulty cable just before the aforementioned difficult reading passages.

If you can, get a teacher. A good teacher will help you when you just can't work out certain sections of music. There are any number of computer programs that will help you work out how a musical phrase should sound, but a teacher will explain how it works and will also help you play it.

22. SLAP BASS

The slap bass technique has evolved over many decades, to the point that it is found in many forms of contemporary music rather than just the funk style in which it first emerged. Rock, pop, and gospel are some of the other styles that have seen slap action.

History

It isn't 100 per cent clear who played the very first electric bass slap parts (upright players had been slapping their fingerboards for many years previously) and in many ways it isn't really that important. After all, we don't concern ourselves too much with who was the first player to develop a fingerstyle from playing with the thumb in downward strokes. But Larry Graham, bassist with Sly and The Family Stone, is certainly credited with bringing slap bass to the masses. After Graham's trio lost its drummer, the teenage Larry and his mom had to provide the sound of a full band at their gigs, as he explains in his tuition section from Glenn Letsch's book *Bass Master Class*: "To make up for not having a bass drum, I would thump the strings on my bass. To make up for not having a snare drum I started plucking the strings. I combined thumping and plucking, and it became the way I played."

The slap technique consists of hitting the strings with your thumb with enough pressure to make them strike the frets, giving a percussive sound. The pop (or pluck, pull, or snap) is the action of pulling the string away from the fingerboard with enough pressure to allow the string to snap back onto the fingerboard to get another hard, percussive, metallic sound. Once Graham had created the foundations, he moved the style up several notches with his own band, Graham Central Station. Stanley Clarke and Mark King (from Level 42) were two players who supercharged the style, adding more percussive techniques, such as the fingerboard hand-slap and machine gun triplets. Before you knew it, the sound of every bass store in the world was echoing to the rat-a-tat-tat of strings against frets. Several more players became closely associated with the technique (it's not really a style), for instance Marcus Miller, Flea, Stuart Hamm, Louis Johnson, Verdine White, Bootsy Collins, and Victor Wooten. Each put his own particular slant on the technique.

The technique

Concentrate on learning one element of the technique at a time. First the thumb.

Figures 16 to 18 (overleaf) show just some of the hand positions adopted by different players. Figure 16 shows the very upright thumb position adopted by Mark King and Stanley Clarke, the earlier exponents. Both these players tended to wear their instruments fairly high. Figure 17 shows the thumb pointing downwards, a position adopted by players who prefer to wear their instruments a little lower on the strap, for instance Flea. Figure 18 shows the middle ground. It's the position I prefer, as there are no extremes of angle or tension in the hand. Try all three and use the one that suits you best.

Note that in all cases the thumb is striking the string against the fret. The motion comes from the wrist and hand, not physically moving your thumb in isolation. As soon as you hit the string against the fret the thumb is pulled away from the strings, otherwise the string will be muted. See Figure 19 (overleaf).

Figure 16
Upright thumb, as used by Mark King and Stanley Clarke.

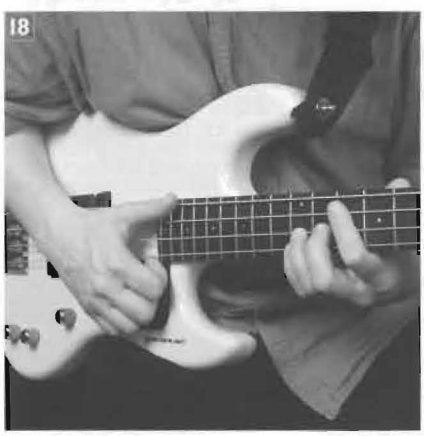


Figure 17
Downward-pointing thumb, as used by Flea.

Figure 18
Middle position thumb.

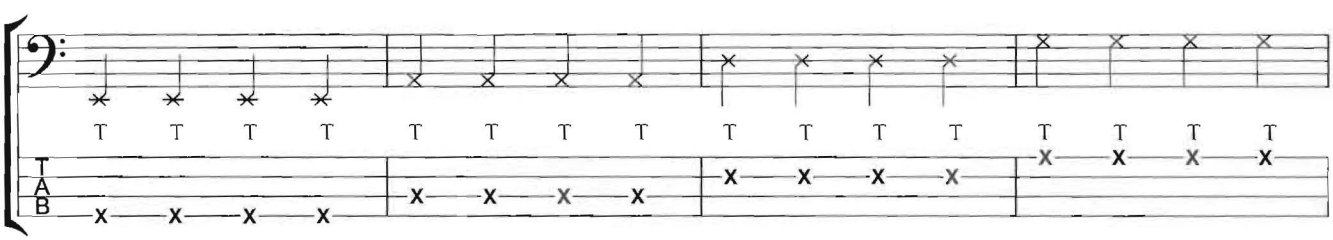
FIGURE 19
Move the thumb away immediately after striking the string.

Accuracy is essential. You must only strike the string that you want to sound. It's a common mistake to strike adjacent strings accidentally.

Experiment with the part of the thumb that hits the string. The area to the side of the knuckle produces the most percussive sound. This will hurt very slightly for a time. It was a common sight to see bassists sporting taped-up thumbs to protect their hands while either learning the technique or hammering it out night after night. Louis Johnson invented a special device called the Louis Johnson Propik that looks like a metal thumb-pick minus the pick part, to protect his thumb and emphasise the metallic sound of the technique.

Exercise 166 involves striking the open strings while muting them with your fretboard hand.

EXERCISE 166



Exercise 167 is similar but uses open strings without muting and alternates strings for cross-stringing practice. Exercise 166 used short notes; this one uses longer notes lasting the full value.

EXERCISE 167

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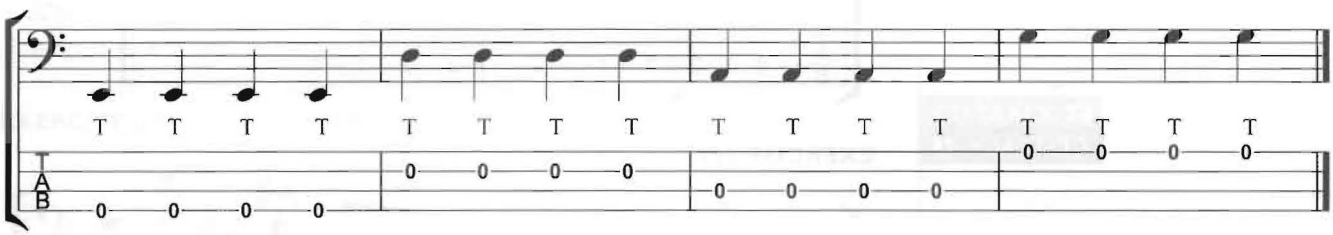
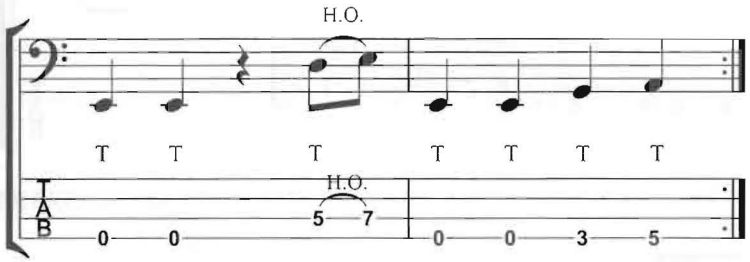


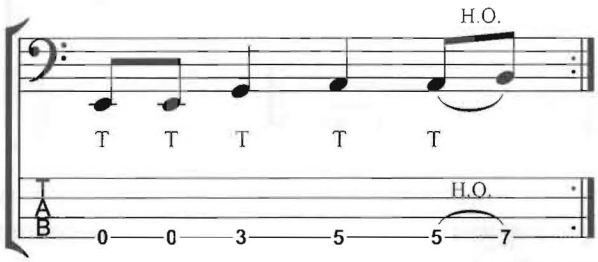
As you are learning a technique, you can apply it to any of the exercises already found in this book. In other words, try using the thumb technique across a major scale or over a triad. Don't feel that slap needs to be employed in a slap/pop fashion. Marcus Miller is one player who uses a lot of thumb without popping all over the place. His thumbed version of Jaco's 'Teen Town' is legendary.

Exercises 168 to 173 show some simple pentatonic-based lines for you to practise.

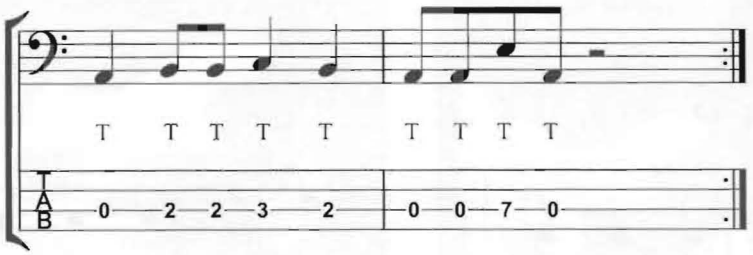
EXERCISE 168



EXERCISE 169

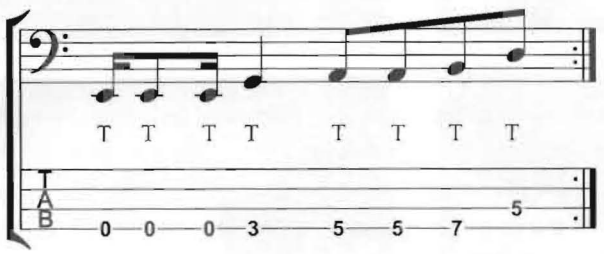


EXERCISE 170



CD TRACK 76

EXERCISE 171



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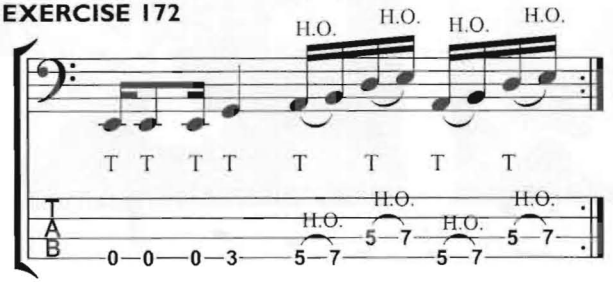
EXERCISE 172



EXERCISE 173

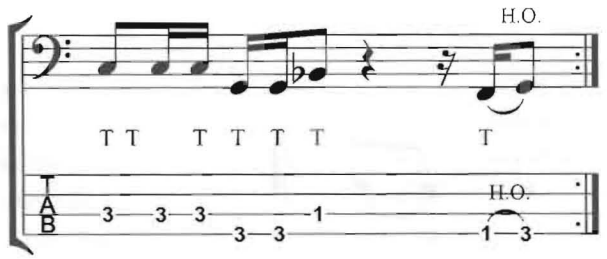


Figure 20
Finger under the G-string, preparing to 'pop'.

Now let's add the 'pop'. Figure 20 shows the ring finger underneath the G-string ready to pull upwards for the string to snap against the fretboard. Figure 21 shows the position of the finger after the pop has occurred.

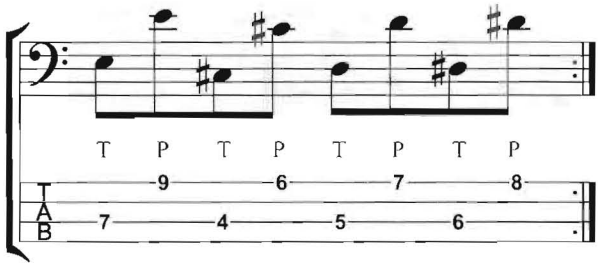
You can thumb any string (not just the lower ones) and you can pop any string (not just the higher ones), although commonly the E- and A-strings are thumbed, with pops on the D- and G-strings.

Some players like to anchor their plucking hand in place by resting their small and ring fingers against the body. You don't need excessive force to get the snap sound. A gentle approach will often yield the same result – but it might not look so good on stage. The motion is similar to a call and answer approach – the pop balancing against the thumbed notes.

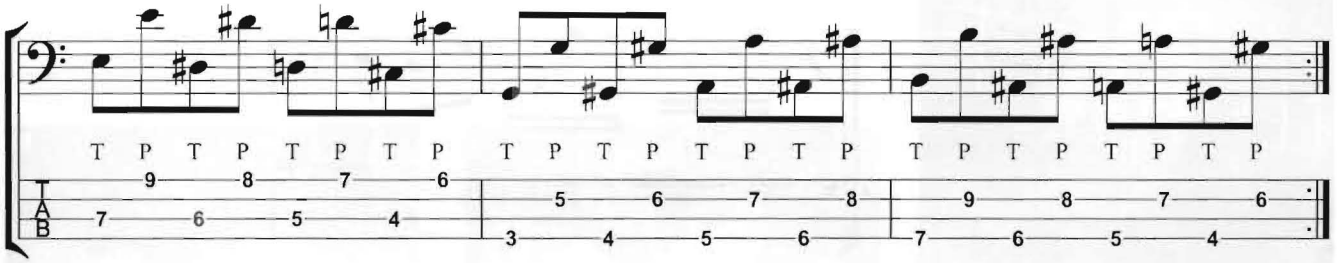
Exercises 174 to 180 show examples of slap and pop grooves. The constantly moving octave pattern is a great exercise to feel the balance between thumb and popped notes.

CD TRACK **78**

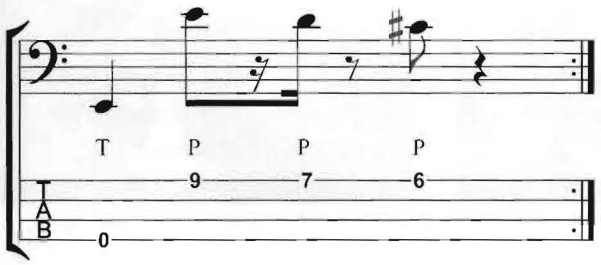
EXERCISE 174



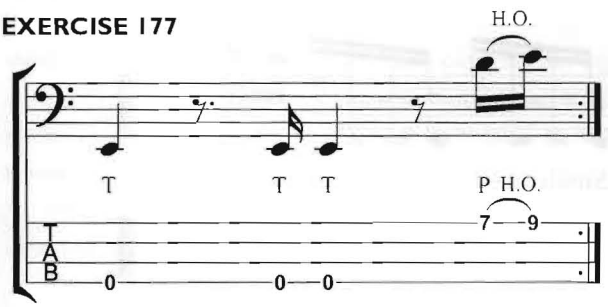
EXERCISE 175



EXERCISE 176



EXERCISE 177



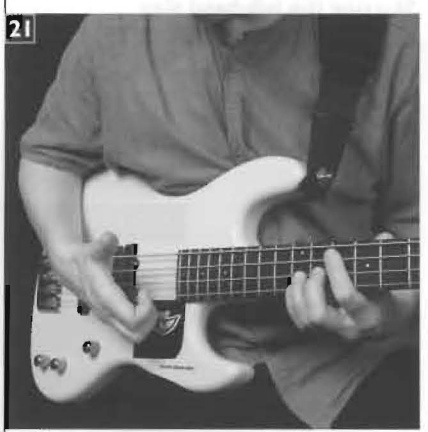


Figure 21
After the 'pop'.

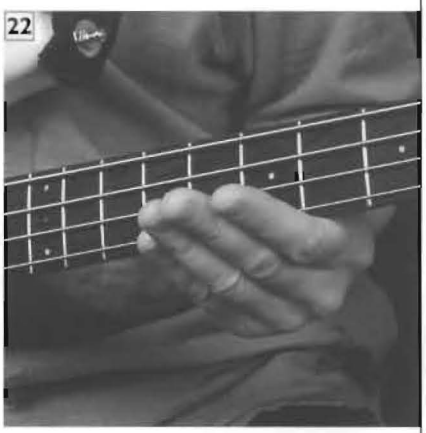
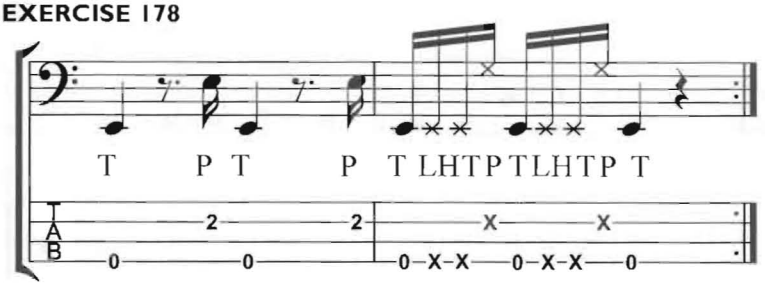


Figure 22
Starting the left-hand slap.

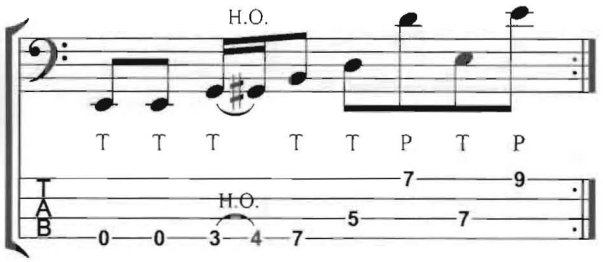
Figure 23
Striking the string to complete the slap.

CD TRACK **79**

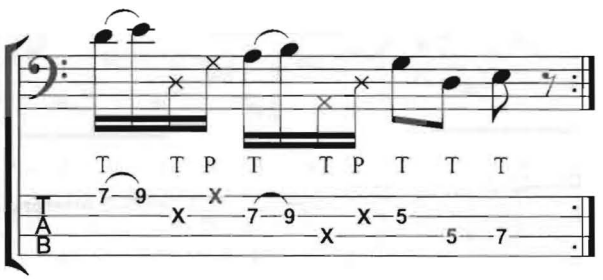
EXERCISE 178



EXERCISE 179



EXERCISE 180

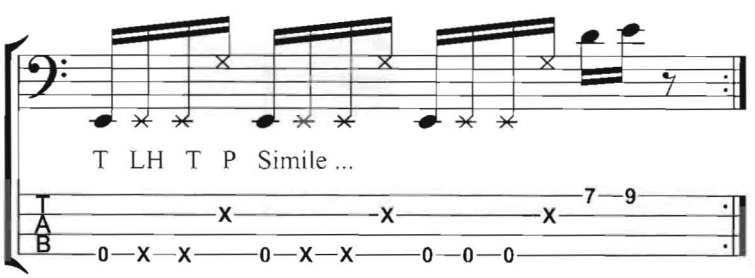


Left-hand slap

This technique involves using the fretboard hand to strike the strings in a percussive manner. Like the call and answer of the slap pop, it can be added to provide rapid drum-like fills. Place the fingers together to provide a tight surface area and strike the hand against the fretboard. Figures 22 and 23 show the position, before and after.

You're not aiming for any particular note. The left hand provides a dead note without pitch. Exercise 181 adds the left-hand slap.

EXERCISE 181



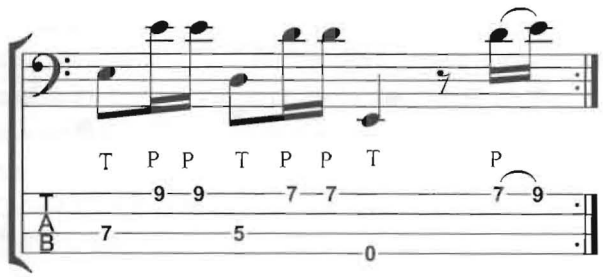
Double plucks

Popping the strings with two fingers instead of one can add interesting variations to a line. Figures 24 and 25 shows the position for this technique. Keep the action smooth and try rolling the wrist across the strings after the thumbed note.

Exercise 182 adds the double pluck.

EXERCISE 182

CD TRACK **80**



Try combining any of the above exercises in any order and coming up with your own lines.

Spicing up your slap groove doesn't necessarily mean adding flashier techniques, unless you can add them in a musical fashion. Imagine if your drummer turned up for rehearsal and played incessant repeated sixteenth-notes on the high hat, kick drum, and snare, without pause; not a nice scenario, is it? So add some of these techniques but remain a slave to the groove and tune. (If you want to get gigs, that is – what you do at home is your own business.)

Figure 24
The first finger has just plucked the string and the second is ready.

Figure 25
Now the second finger has plucked and is pulling away.

23. MODES

While studying at the Bass Institute of Technology in Los Angeles, I was given this gem of advice: "If you want to get lots of students, tout yourself as being able to nail the modes." What is it about modes that makes them so mystical, so confusing, so ... highbrow? The answer may shock you: nothing.

Treating modes as some sort of elevated higher form of musicianship is probably a device for retaining students, as mentioned above. Let's strip away the mysticism.

Their names are certainly exotic: Ionian, Dorian, Phrygian, Lydian, Mixolydian, Aeolian,

Locrian. But the seven modes are just – shock horror – seven scales. Learn seven more scales just like you learned the major scale – actually, the major scale *is* the first mode, so that leaves just six – and you can play the modes. That isn't meant to undermine the depth of study and practice the modes require. There's still a significant musical journey in applying and making music with these scales. But don't be frightened of them.

Modes have been around in one form or another for a long time. From the earliest plainchant of the eighth and ninth centuries, through the Middle Ages, and into the current music scene, modes can be found in many styles of music. Like so many of our scales, the modes have a formula. What makes modes a bit unusual is the way that they are sometimes formulated. A mode is essentially a seven-note scale (eight if we include the octave, which we will in all the exercises). To find the pattern of tones and semitones in each mode you play just the white notes on a keyboard (the C major scale), but starting from different degrees of the scale. The first mode is created by playing from C to C. That first mode is called the Ionian mode, and yes, it is exactly the same as our C major scale. C major = C Ionian.

To create the second mode, start playing from D, the second scale step of C major. This gives us the mode called Dorian, whose notes are D E F G A B C D. This system continues for all the scale steps until we reach B, ready to repeat from C again. The modes are shown in Exercise 183, which also shows the major scale that starts on the same note, so you can see how they differ. Note: the mode is the pattern of notes rather than any particular set of notes. You can play any mode's pattern from any starting note.

Leaving the explanation there is only half the story. Many performers use the modes as an improvisational and compositional tool. In other words, the tune is based on one or more modes. The best example for demonstrating this is 'So What' from *A Kind of Blue* by Miles Davis. The tune rotates around a sequence comprising D Dorian and then E♭ Dorian. Trying to play C Ionian over D Dorian won't necessarily work well – it will sound like you're playing in C, although some tutors try to get you to do this. To understand modal playing you need to see the mode as a unique scale with its own specific series of tones and semitones. Comparing it to its parallel major scale is a good way to achieve this. In other words don't think of D Dorian as the second mode of C. Think of it as D Dorian, a mode (scale) on its own with its tonal centre at D. Both ways of expressing the modes and their exotic names are listed below. Of course all our scale drills can be applied to the modes. Note: the Aeolian mode is our natural minor scale.

THE MODES COMPARED WITH THEIR PARALLEL MAJOR SCALES:

C Ionian = C Major.

D Dorian = R + 2 + ♭3 + 4 + 5 + 6 + ♭7, compared with D Major.

E Phrygian = R + ♭2 + ♭3 + 4 + 5 + ♭6 + ♭7, compared with E Major.

F Lydian = R + 2 + 3 + ♯4 + 5 + 6 + 7, compared with F Major.

G Mixolydian = R + 2 + 3 + 4 + 5 + 6 + ♭7, compared with G Major.

A Aeolian = R + 2 + ♭3 + 4 + 5 + ♭6 + ♭7, compared with A Major.

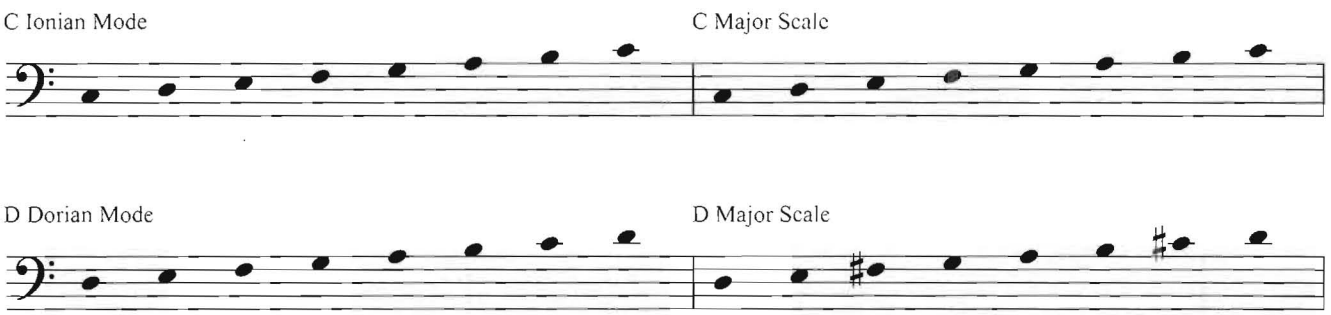
B Locrian = R + ♭2 + ♭3 + 4 + ♭5 + ♭6 + ♭7, compared with B Major.

THE NOTE OR NOTES THAT GIVE EACH MODE ITS CHARACTERISTIC SOUND:

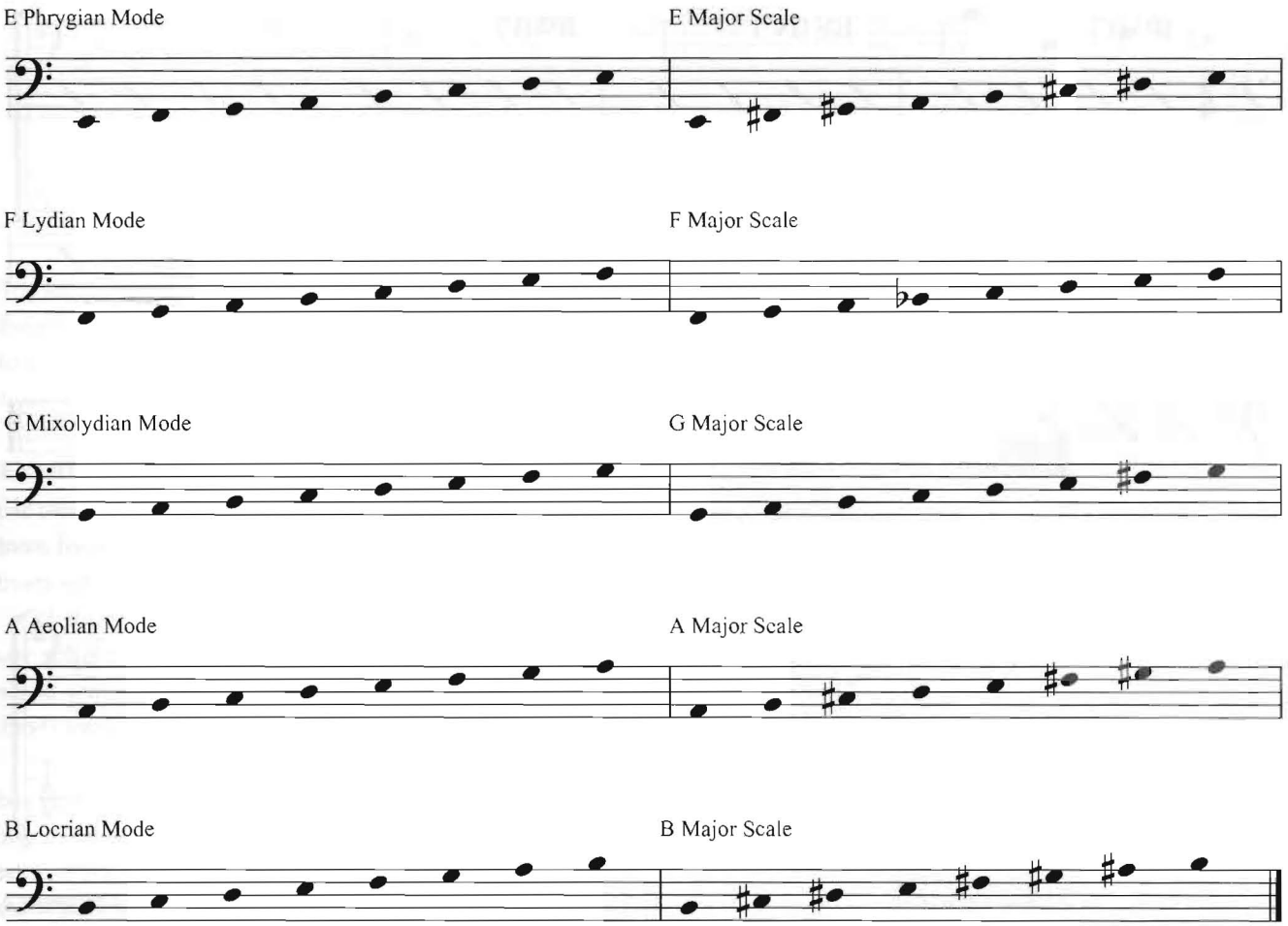
Ionian	Major scale
Dorian	Flat 3 Natural 6
Phrygian	Flat 2
Lydian	Sharp 4
Mixolydian	Major 3 Flat 7
Aeolian	Natural minor scale
Locrian	Flat 2 Flat 5

CD TRACK 81

EXERCISE 183



Exercise 183 *continued*



24. JAZZ BLUES PERFORMANCE CHART

This chart encompasses all of the study sections in this book. Chord analysis, triads, seventh chords, scales, and modes can all be potentially encompassed in a walking bassline as found in a jazz blues. Be aware that there's rarely a typical jazz blues.

The chart

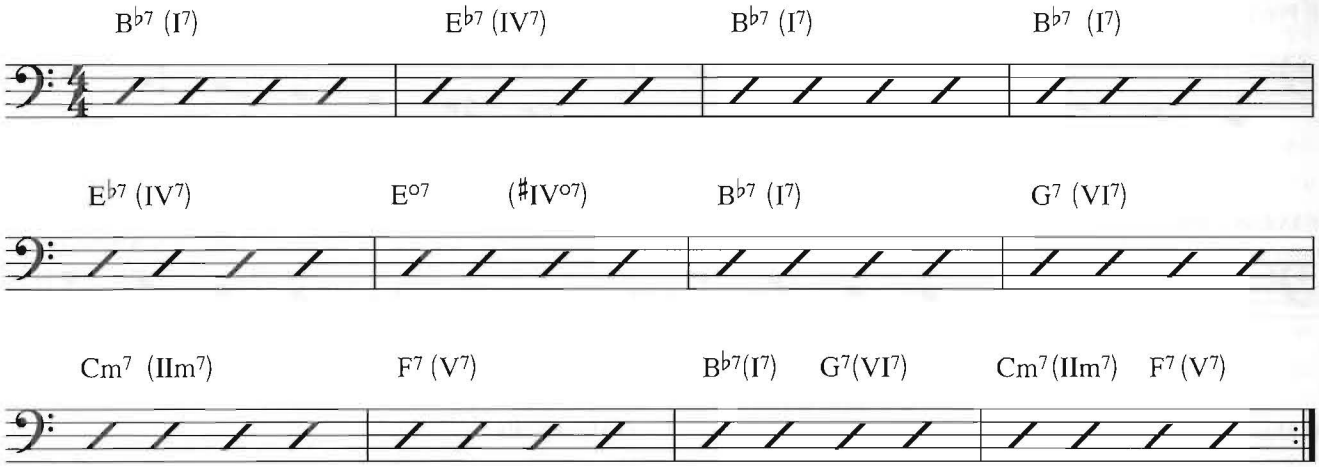
Based upon the traditional I IV V structure of a standard blues, the jazz blues adds more chords for harmonic interest. These chord additions can vary in their number and complexity. Sometimes additional II V progressions are added from other keys, or perhaps the diminished chord we see here at bar six might be absent. There are many variations and sometimes only a good ear will help you discover them if you don't have the chart. But learning the chart here will help you get to grips with a common jazz blues format, as shown at Exercise 184. CD track 82 is the chart without bass.

INVENTED MODES

Modes can also be invented, by building them from minor scales. The resulting scales are usually named as alterations of the existing major scale modes. Thus the sixth mode of an F ascending melodic minor scale comprises the notes D E F G Ab Bb C D and the intervals Root 2 b3 4 b5 b6 b7. That is the same as a Locrian mode apart from the raised second degree, so this scale is often referred to as a Locrian ♯2 scale.

CD TRACK 82

EXERCISE 184



Although harmonically more varied, the 12–bar format remains and the first I7 chord and bar five IV7 chord are retained from the major blues format. The extra fully diminished chord at bar six is raised a half step from the IV. It looks complex but by analysing the chord tones you can see that little has changed. E♭7 = E♭ G B♭ D♭, whereas E°7 = E G B♭ D♭.

What has changed is the root, and that needs to be emphasized in the line you create. Bar eight introduces another new chord, the VI chord. In our harmony of the major scale we would expect this to be a minor chord but here it is a dominant chord. This is far more common than a minor chord although either can occur.

Note that the changes are for a quick change I-IV in the first two bars. Don't try and 'walk' a smooth voice-leading part before you can 'run' through the basic changes, outlining the chord tones of each chord. The harmony is for blues harmony, and thus the I, IV, and V chords are dominant chords. In standard major-scale harmony, the I and IV are major seventh chords.

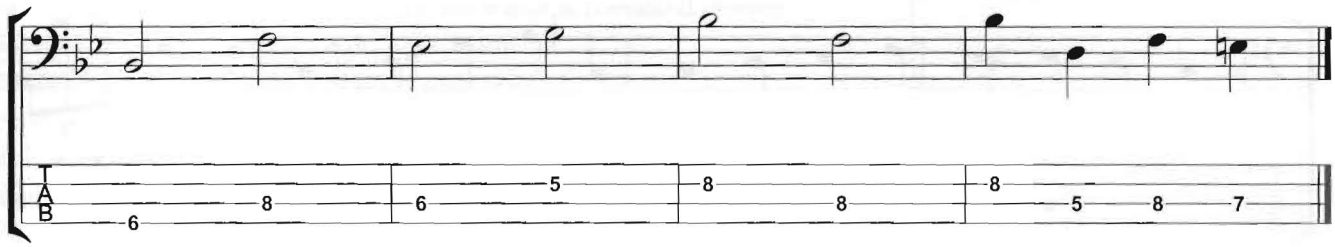
The end of the progression is harmonically more varied. The I7 chord at bar seven starts a one-chord-per-bar turnaround section, followed by the dominant VI7, minor II (Cm7) and dominant V (F7). The same chord sequence is then repeated, but with two chord changes per bar as a I VI II V turnaround that brings us back to the start and the I chord (B♭7). Such chord progressions are often referred to as simply playing the changes.

Creating a bassline

The first time the tune is played through, a line that works well uses just chord tones that last a half-note each. This serves two purposes. Firstly, it is a common feel used in jazz, often to allow a melody to be played over it. Secondly, it gives you a chance to feel your way through the chart and get used to the chord changes. Although it comprises mainly roots and fifths, the odd third and seventh can be thrown in for melodic and harmonic interest. Exercise 185a shows the line for the first four bars of the tune.

EXERCISE 185A

CD TRACK **83**

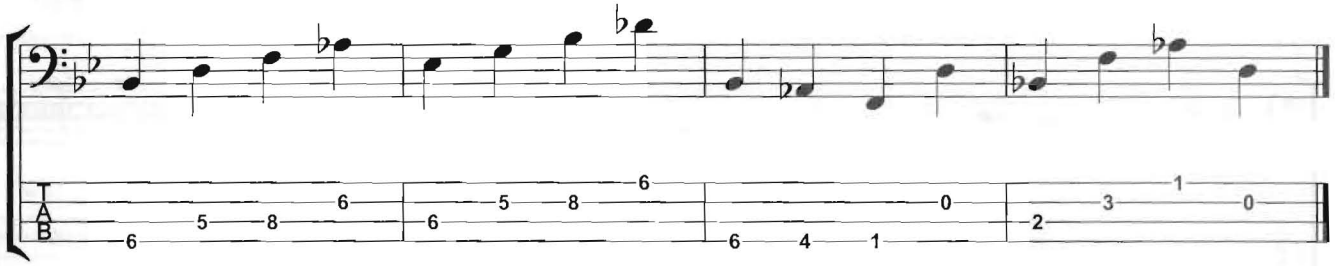


The second chorus consists of a walking line using just the chord tones from each chord. Exercise 185b illustrates the first four bars played this way. You have to work out the part to play over the remaining changes. If you struggle with any, refer back to the chapters on triads and seventh chords.

EXERCISE 185B

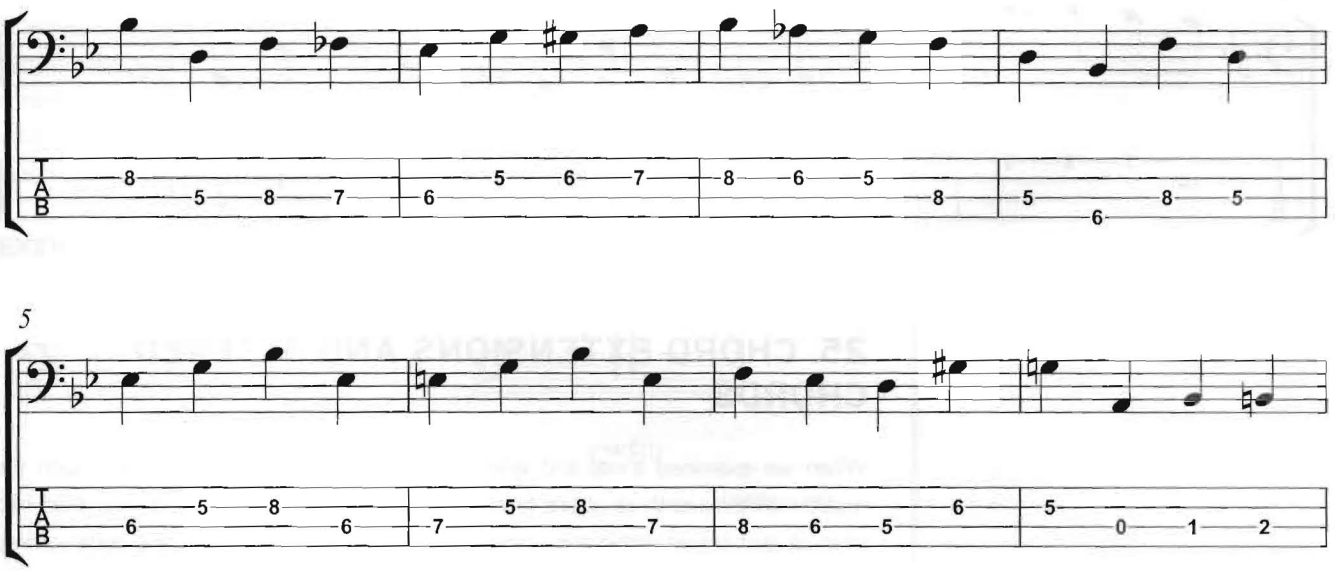
CD TRACK **83**

The third and fourth choruses combine scale ideas, passing tones and larger interval leaps. The lines played in full are all shown at Exercise 185c.

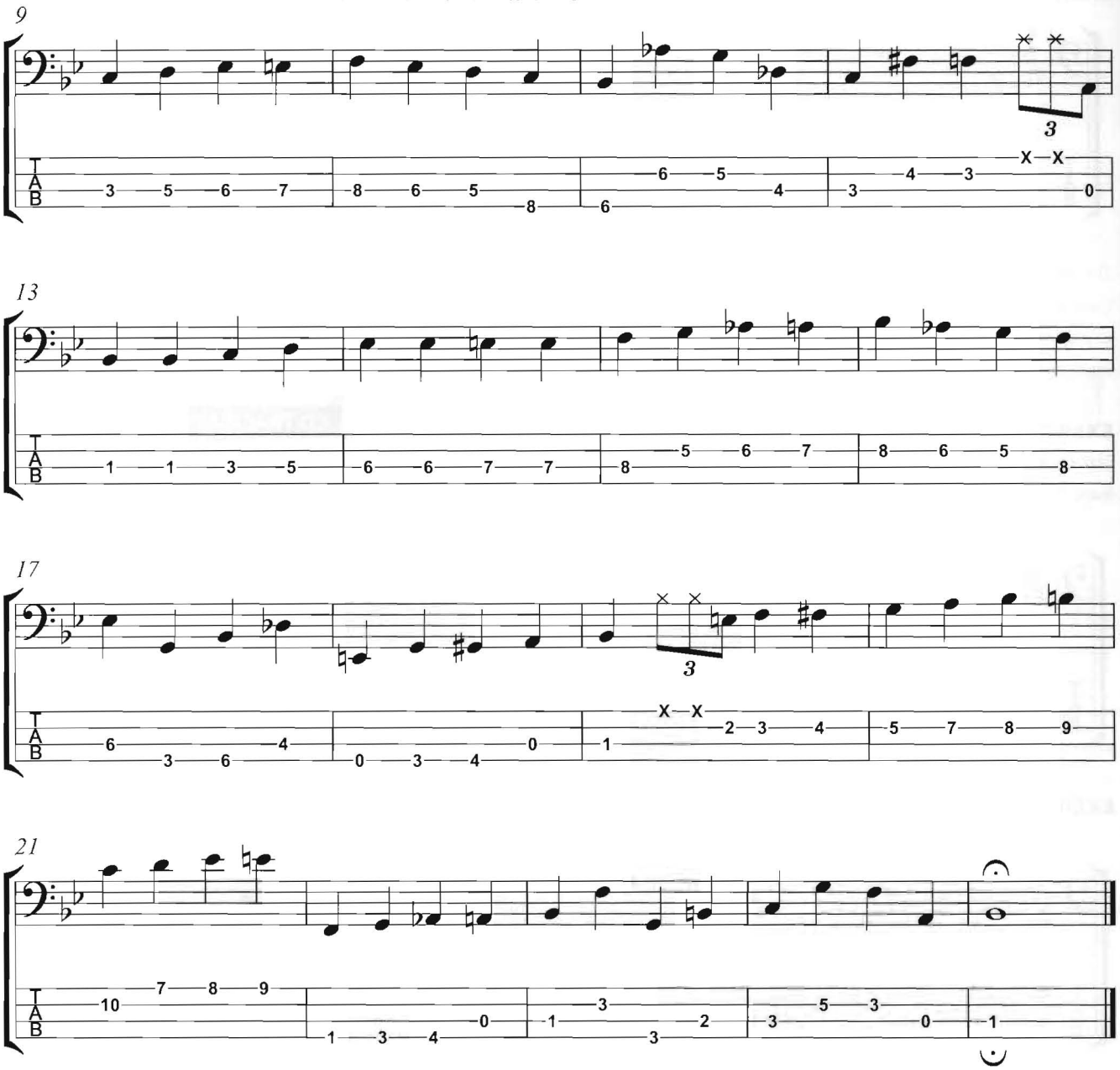


EXERCISE 185C

CD TRACK **83**



Exercise 185c *continued*



25. CHORD EXTENSIONS AND ALTERED CHORDS

When we examined triads and seventh chords, we saw that chords built upon the root/third/fifth/seventh structure formed the basis of most chords. We also examined intervals that stayed within the octave. The great range of the piano and wide voicings achievable on electric guitar however can easily accommodate chords with added notes and wider intervals. These are known as altered chords and chord extensions respectively.

Chord extensions

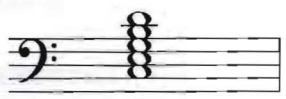
Intervals that stretch beyond the octave are also known as compound intervals.
Moving a second above the octave produces a ninth.
Moving a third above the octave produces a tenth.
Moving a fourth above the octave produces an eleventh.
Moving a fifth above the octave produces a twelfth.
Moving a sixth above the octave produces a thirteenth.
Moving a seventh above the octave produces a fourteenth.

Note: The fourteenth is rarely found or so named in practice. The tenth and twelfth duplicate the third and fifth. The common extensions are therefore the ninth, eleventh and thirteenth.

Chords are named according to the largest interval present: thus a thirteenth chord theoretically includes a ninth and eleventh. In practice, the chord may sometimes miss out certain chord tones, but if there is an important extension it may be included in parenthesis, eg, C13 (♯11). The basic chord quality is maintained; a thirteenth chord still contains a major triad as its foundation.

Ninth chords are constructed by adding a major ninth to a seventh chord, whether major, minor or dominant:

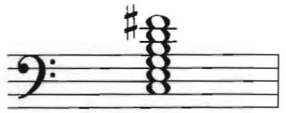
EXERCISE 186



$C^{\Delta 9}$

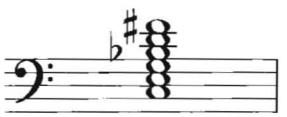
Eleventh chords are more complex. The theory suggests we just add a perfect eleventh. However, on major or dominant chords this gives us a minor ninth interval between the third of the chord and the eleventh, an interval that is considered to be quite harsh. The answer is the same approach that we discussed in minor scale harmony. We move the note to make it sound good! Therefore in major and dominant chords the eleventh is raised a semitone and the resulting chord looks like Exercises 187 and 188.

EXERCISE 187



$C^{\Delta 9(\sharp 11)}$

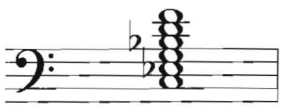
EXERCISE 188



$C^{9(\sharp 11)}$

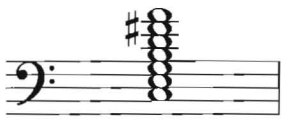
Minor chords have a minor third and the dissonant interval isn't present, so simply add a perfect eleventh as at Exercise 189.

EXERCISE 189



Cm^{11}

EXERCISE 190



$C^{\Delta 13(\sharp 11)}$

Sometimes composers remove the third altogether, and the result is known as a suspended or sus4 chord.

Thirteenth chords are constructed by adding a major thirteenth interval to an existing eleventh chord. The thirteenth is one extended chord where the eleventh may be left out, unless stated in the chord voicing, as at Exercise 190.

Altered chords

While it isn't possible to alter the basic quality of a chord (major, minor, augmented, diminished) the chord extensions are often seen as having a secondary importance. Some people refer to these as colour tones. Think of them as shades of different colours, the basic chord tones representing the primary colour. The following extensions are commonly altered:

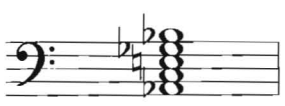
Ninth becomes flattened ninth or sharpened ninth.

Thirteenth becomes flattened thirteenth.

In addition the fifth may be lowered (flattened fifth) or raised (sharpened fifth).

Some chords may have both extensions and alterations. For example, $A\flat 7(\sharp 5)$ incorporates the ninth (an extension) and the sharpened fifth (an alteration) as shown at Exercise 191. (It is a convention that altered chords often include the ninth, even if that is not included in their name.)

EXERCISE 191



$A^{\flat 7(\sharp 5)}$

Other common chord alterations include:

Minor/major seventh chord: a minor triad with a major seventh interval added.

Major or minor sixth: a major or minor triad with an added major sixth.

Power chord: a two-note chord consisting of a root and a perfect fifth.

Slash chords

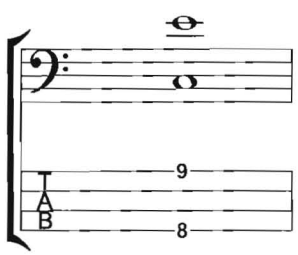
Sometimes chord voicings can get incredibly complex for bassists. What should we play? What does the composer want to hear? Luckily, a great deal of contemporary music employs the slash chord, whereby a triad or seventh chord is specified and a bottom note indicated on the other side of diagonal (slash) line, eg, C/E C7/G. In these cases the bass will play the E or G under the chord, unless soloing, in which case working off the upper chord may be more melodic.

26. BASS CHORDS

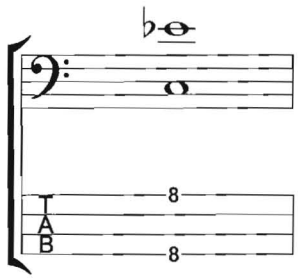
Isn't playing chords something that guitarists do? Imitating guitar chords on the bass can be done, but particular care must be taken in where they are played and their voicing. The very first step in getting to grips with bass chords is to understand the theory. If you can understand the information on intervals, triads, and seventh chords, you shouldn't need to look at a single chord diagram to see where to place your fingers on the bass. Make the chord shapes in such a way that the root is played on the lower string, with the third, fifth or seventh on the upper strings. That way they can be played with clarity. To grasp this concept, start with just two-note chords.

Exercise 192 shows the root and third of a major chord. The root is played on the E-string, the third on the G-string and therefore up an octave. This gives us a compound interval of a major 10th (See Chord Extensions and Altered Chords, p230).

EXERCISE 192



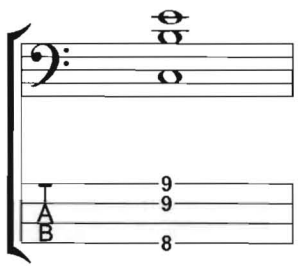
EXERCISE 193



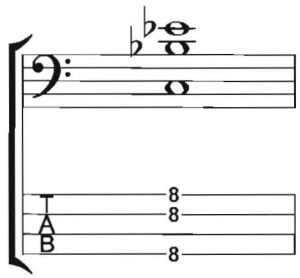
Exercise 193 shows a minor 10th; the root remains the same but we apply our major to minor formula by lowering the third a semitone. Think of the theory rather than slavishly following the chord diagrams.

Let's make these chords into seventh chords. Adding the fifth can muddy the sound, and as it doesn't add anything to alter the major/minor structure we can leave it out. So let's create a major seventh chord. Exercise 194 shows this. Our chord is 'voiced' root/seventh/third.

EXERCISE 194

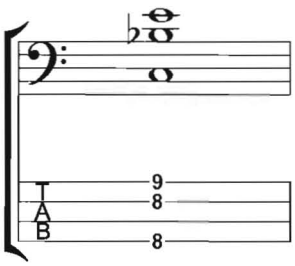


EXERCISE 195



Making it a minor seventh chord involves lowering the third and the seventh, as in Exercise 195.

EXERCISE 196



Exercise 196 shows a dominant chord.

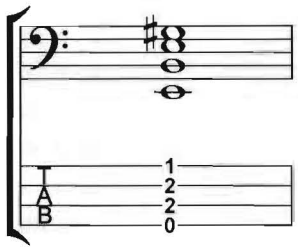
Note that playing the root on the E-string creates a large interval between it and the upper parts of the chord, enhancing the clarity of the sound. If you play the root of the chord on the A-string you get a more standard voicing, either root/fifth/seventh or root/third/seventh. Playing the chords can be done using a thumb downstroke on the root and finger upstroke on the upper voicing.

Try playing a chord progression. Jazz standards work very well for this. Some players, such as Steve Hackett bassist Terry Gregory, add melody and walking basslines to the chords in the style of guitarist Martin Taylor.

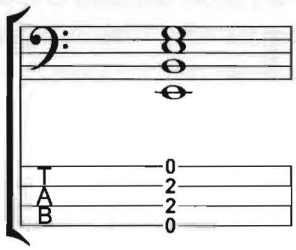
In some circumstances you can play the higher notes of the chord on the lower strings. A fat rock chord with a bit of distortion to soften the lower frequencies works well, see Exercises 197 and 198.

Figure 26
Playing a chord. Note that the root is on the E-string, leaving a large interval between it and the upper notes of the chords, which are on the D- and G-strings.

EXERCISE 197

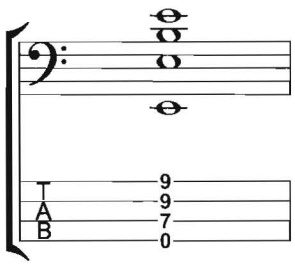


EXERCISE 198



And the classic full-fat E chord (root/octave/fifth/octave), as in Exercise 199, is a good way to end a jam.

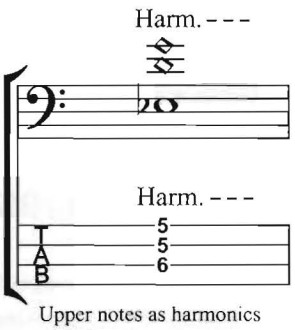
EXERCISE 199



Chords and harmonics

Take a chord and add either natural or artificial harmonics (see p238), as shown in Exercise 200.

EXERCISE 200



Now turn your volume off, play the chord, and gradually bring up your volume to produce a synth-like swell without the need to pay for a synth pedal. Adding delay adds even more interest.

27. MORE SCALES

There are many books dedicated to scales, offering hundreds of patterns and exercises, all based upon the many variations heard in different types of music. It would be fair to say that most scales, over and above the major, minor, and pentatonic varieties, are found in jazz improvisation. That is hardly surprising when jazz legend Charlie Parker was quick to point out he might spend eight hours a day practising the major scale alone. Learning the major scale, pentatonics, and the modes should give most players all the scales they'll reasonably ever need. There are, however, a few useful scales that feature more exotic intervals than those studied so far. They are good improvisational tools when you encounter altered chords.

Altered scales

There are several altered scales, which are used in different circumstances.

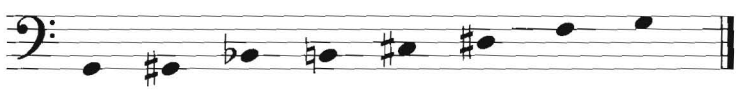
THE ALTERED SCALE

As its name suggests, the altered scale (also known as the Super Locrian) works well over chords that have been altered from their standard form (See Chord Extensions And Altered Chords, p230). Using the basic major scale of the key centre won't necessarily sound good over chords incorporating altered ninths, elevenths and thirteenths. The altered scale incorporates these alterations in its formula, which is: root/flattened ninth/sharpened ninth/third/diminished fifth/augmented fifth/minor seventh (R + ♭9 + ♯9 + 3 + ♭5 + ♯5 + ♭7).

Exercise 201 shows a G altered scale.

CD TRACK **84**

EXERCISE 201



This scale works best when it is played over an altered chord that functions as a dominant V moving to the I chord. The altered notes are referred to as ninths rather than seconds to indicate their function in the chord from which they derive, and because chords are built around thirds: root/third/fifth/seventh/ninth/eleventh/thirteenth, etc.

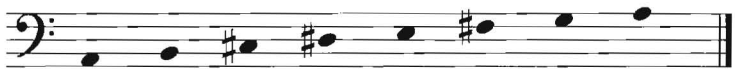
THE LYDIAN ♭7

For altered dominant chords that don't function as resolution chords, the Lydian ♭7 scale is the preferred choice.

The Lydian ♭7 scale, also known as Lydian dominant, is exactly what its name suggests. It's a Lydian mode with a flattened seventh. Its formula is: root/second/third/augmented fourth/fifth/sixth/minor seventh (R + 2 + 3 + ♯4 + 5 + 6 + ♭7).

Exercise 202 shows the A Lydian ♭7 scale.

EXERCISE 202



THE DIMINISHED SCALE

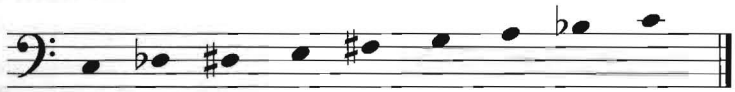
The diminished scale is a symmetrical scale with a regular alternation of tones and semitones. This means it holds the unusual distinction of having eight scale steps excluding the octave. It can only start in two possible ways. With the tone interval played first it is known as the diminished scale (Exercise 203):

EXERCISE 203

If the semitone interval is played first it is known as the dominant diminished scale (Exercise 204):

EXERCISE 204

CD TRACK **85**



The formulas are as follows.

Diminished: root/ninth/minor third/fourth/diminished fifth/minor thirteenth/thirteenth/seventh (R + 9 + ♭3 + 4 + ♭5 + ♭13 + 13 + 7).
Dominant diminished: root/flattened ninth/sharpened ninth/major third/ sharpened eleventh/fifth/thirteenth/minor seventh (R + ♭9+ ♯9 + 3 + ♯11 + 5 + 13 + ♭7).

The diminished scale works over diminished chords, the diminished dominant over altered dominant chords. What *really* works is what sounds good.

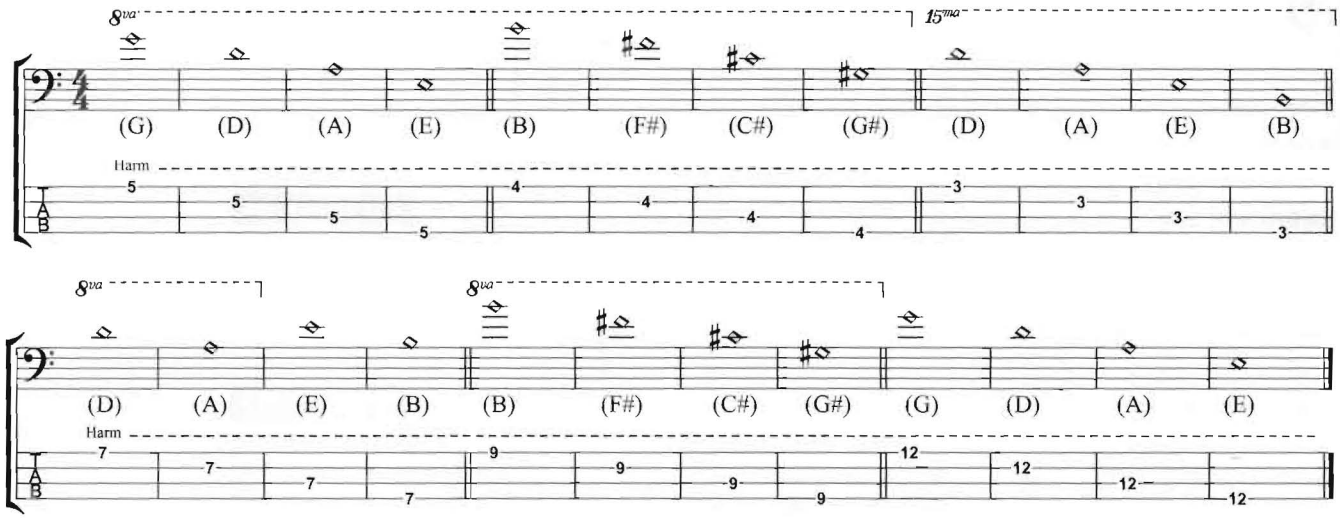
28. HARMONICS

Harmonics are bell-like ringing sounds present in many instruments, part of the complex acoustics of each and every note we play. Although it would make sense that when we pluck a string and produce a note it vibrates at a certain frequency, there is actually a lot more going on. The note produced at each frequency is called the fundamental; it is the note we immediately hear. But the string also vibrates in further subdivisions that are harder to hear – unless we 'stop' the subdivision so it sounds above the fundamental. These are our harmonics. Two types of harmonics are used by bass players: natural and artificial.

Natural harmonics

Natural harmonics are used when tuning up, and are sounded by touching the string positively but lightly with the left hand, without pushing the string down, and then plucking with the right hand (Figure 27). Removing your left hand at this point allows the harmonic to carry on sounding (which is why it is used in tuning up, because it frees the hands). But where should we play them? Natural harmonics occur at several node points (string subdivisions). Sometimes the note is the one expected, for example the octave G harmonic at the 12th fret. Sometimes it isn't, for instance the sound a major third and two octaves up that you get at the ninth fret harmonic. The harmonics chart (Exercise 205) shows in the tab where you play the harmonic; the notation shows the actual note produced. Diamond note heads represent playing the note as a harmonic.

EXERCISE 205



Note that compared to the open string:

The 12th fret harmonic produces a note an octave up.
The ninth fret harmonic produces a note up two octaves plus a third.
The seventh fret harmonic produces a note up one octave plus a fifth.
The fifth fret harmonic produces a note up two octaves.
The fourth fret harmonic produces a note up two octaves plus a major third.
The third fret harmonic produces a note up two octaves plus a fifth.

You can play these harmonics in isolation or combine them with fretted notes to produce lush chords. Check out Jaco Pastorius's 'Portrait of Tracy', a pioneering example of a tune embracing harmonics and chords.

Using natural harmonics, we have intervals of a third, fifth, and octave – the ingredients of basic triads and chords. Play the harmonics at the fifth, ninth, and seventh frets for a root/third/fifth triad on any open string.

Artificial harmonics

There is another way of getting harmonics from your instrument without having to learn where all the natural harmonics lie. By fretting a note and then playing a harmonic with your plucking hand an octave above the fretted note, you can produce a harmonic an octave above the fretted note. The trick, however, is that you need to pluck the note and lightly touch the string with the plucking hand alone. There are several ways of doing this. The most common is to use your finger or thumb to touch the harmonic while simultaneously plucking with another finger behind it (Figure 28). This is sometimes referred to as the 'moveable nut' concept, reflecting the fact that your left hand now becomes the 'nut' of the bridge, constantly changing the scale length. Harmonics can be slid and bent like normal notes (sliding harmonics on fretless are particularly effective). Once again, Jaco Pastorius brought artificial harmonics to the fore of electric bass playing when bassists started asking what the squealing high-pitched sounds were on the intro to 'Birdland' from *Heavy Weather*.

Tap harmonics

Another method for playing harmonics is to tap the note while fretting it, usually an octave above. The technique involves lifting your tapping finger off the note immediately so the harmonic rings out: see Figure 29.

Pinch harmonics

Pinch harmonics involve using the thumb and first finger in a pinching motion to sound the harmonic. Billy Sheehan uses these to great effect in his playing, having heard ZZ Top guitarist Billy Gibbons use them. They require a fair amount of commitment, otherwise they sound a bit lame. When you get them right, you can, as Billy puts it, "See the audience drop in the back rows!"

29. FRETLESS TIPS

Through his work as a session player and sideman, Mo Foster has recorded with hundreds of artists including Jeff Beck, Gil Evans, and Cher; as well as providing bass for a host of film scores from the James Bond series to The Pink Panther.

A superb fretless player with 28 years of experience, Mo offers the following advice: "If you really want to know the secret of getting a great fretless sound, it's easy. It's the player! Whilst on tour with Jeff Beck I heard him do his little warm-up routine on guitar backstage and I was amazed to turn around and see him jamming on an old Rosetti guitar. But it still sounded like him. The instrument was secondary."

Nonetheless, Mo has spent many years analysing how to get the best from a fretless bass, although the way it's often taught, Mo agrees, is "a black art that no-one's explained, really".

Tip one: vibrato is important

"It makes the instrument transcend into something beautiful. I took a lot of tips from cellists who used vibrato from the elbow rather than just the hand. Jaco did this too but

Figure 27
Sounding a natural harmonic at the seventh fret.

Figure 28
Sounding an artificial harmonic.

Figure 29
Tapping a harmonic.

then there are players like Pino, who prefers to slide up and down from the hand, so it can all work. You just have to think of it as a voice rather than an instrument."

Tip two: your plucking hand also plays an important part

"Instead of playing at the bridge, try playing over the neck itself. And instead of plucking the note, you can roll the edge of your finger off the string for a warmer tone."

Tip three: get your intonation set correctly

"Although it's hard to do on a fretless bass, because you yourself become the fret, it's important to get it right." Some luthiers use a credit card instead of a finger to make more precise adjustments. Intonation also needs to be set according to how you fret each note – behind the line or on the line – assuming you have fret markers.

Tip four: examine your fingerboard hand technique

"Players often favour either a fretting hand position using classical double-bass method (as invented by Simandl, whereby fingers one and two play the first two frets of any position and then fingers three and four play the octave or third fret position), or the classic 'one finger per fret' method. For example, if you were playing an octave of the low F, the one finger per fret method would hurt! But you have to then be able to seamlessly switch to a one finger per fret method when that's required."

Tip five: a hard fingerboard can help

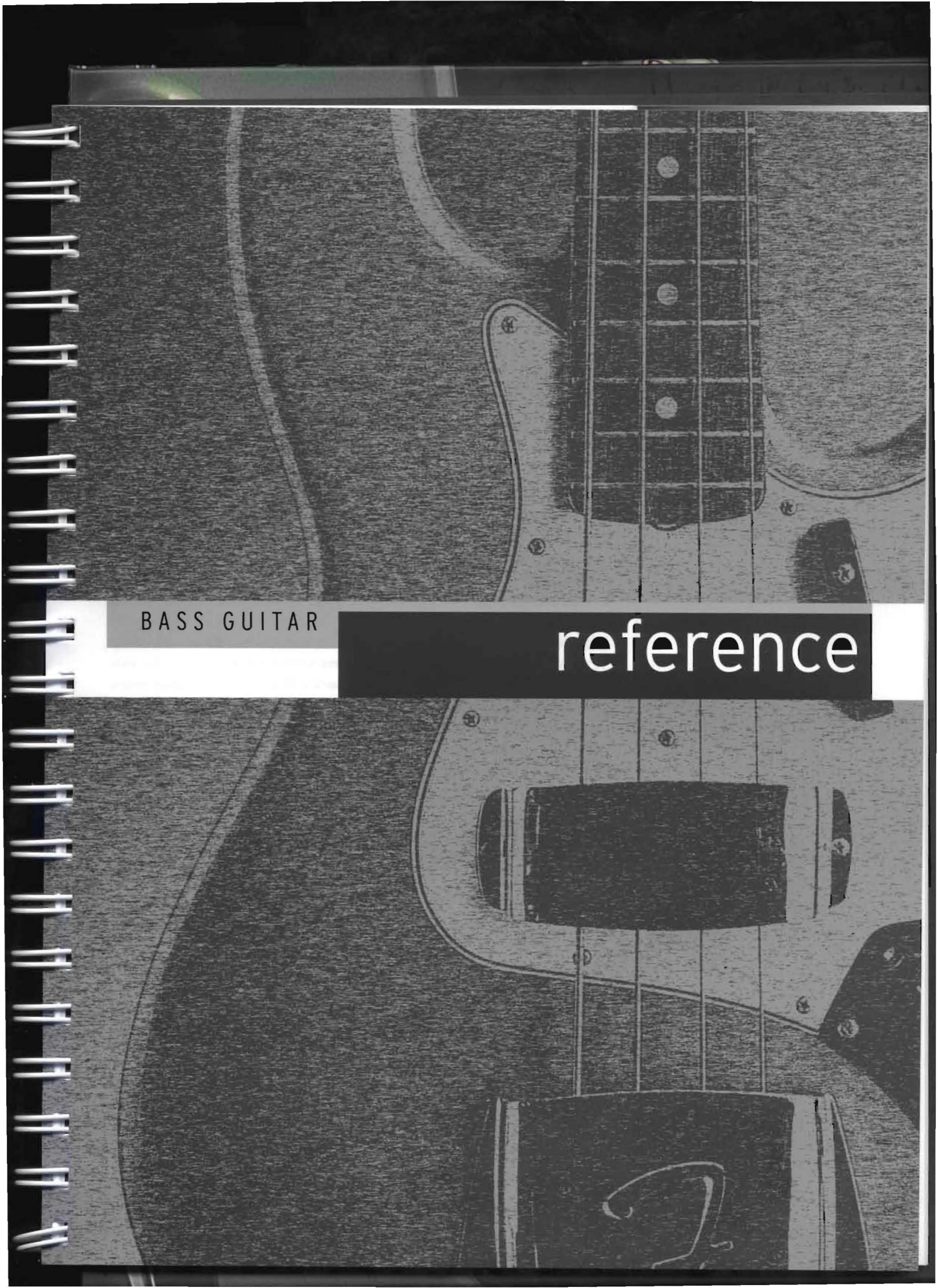
Like bassist John Giblin, Mo Foster had his electric bass neck replaced with a 100-year old neck from an upright bass, with the work carried out by Neville Whitehead, a repair man for the London Symphony Orchestra. "He fitted my neck in 1976. I had to keep going back to his workshop – it was a bit like being fitted for a suit!" But it's not an exact science, the bassist explains: "Getting the sound is an art!"

Tip six: don't be frightened by lines

Despite losing you marks for cool, having lines placed on a fretless fingerboard can really help. "Markers are essential for a visual check," says Mo, "although after that it's down to fingers and ears. I prefer to have dot markers on the side of the fingerboard in the same places as one would find on a fretted bass, because I am changing regularly between fretted and fretless basses, and the side dots need to stay the same." But, be warned, many manufacturers who make unlined fingerboards will put dot markers where the fret would have been, a more common approach. Zon offers a fretless with small markers that protrude about 5mm on to the board, leaving the cool look with some reference for playing in tune.

Tip seven: listen!

Listening is one of the best ways to learn any instrument. (See Recommended Listening, p240).



BASS GUITAR

reference

RECOMMENDED LISTENING

Creating a shortlist of recommended bass-related music is a bit like creating a list of basses you must play. There's little logic in it, and personal preference plays too great a role. But expanding your horizons and listening to music you might not otherwise have considered may make you a better player. That's a risk worth taking, I say. These albums have had a huge impact on bass playing across the globe, rather than changing the face of music itself. Sometimes, though, they did both. And in a nod to recent trends, boxed sets and greatest hits collections are thrown in as well.

Weather Report

HEAVY WEATHER

Bassist: Jaco Pastorius

After knocking the bass community senseless with his self-titled debut, Jaco Pastorius went on to join fusion masters Weather Report, and if one album captures them at their finest it is *Heavy Weather*. Jaco's contribution to Joe Zawinul's masterpiece is legendary. The soaring, melodic fretless lines on 'A Remark You Made' and the pulsating, technique-busting 'Teen Town' are as impressive today as they were 30-odd years ago.

Stanley Clarke

SCHOOL DAYS

Bassist: Stanley Clarke

Where Jaco was breaking new ground on fingerstyle bass, Stanley Clarke was doing the same with his slap and pop style. 'School Days', the title track, is seen as a bass players' anthem. With strummed descending fifths, slapped octave Es, rapid fire pentatonics and twisting harmonics, *School Days* had calluses working overtime from its 1977 launch to this day.

The Beatles

SGT. PEPPER'S LONELY HEARTS CLUB BAND

Bassist: Paul McCartney

The *Sgt. Pepper's* album revolutionised music for ever, with the Fab Four daring to tread where none had been before, their studio time no longer interrupted by touring commitments. McCartney's bass playing was also bolder than before, combining rock straight eights on the title track, flowing arpeggios on 'Lovely Rita', and melodic scale-like lines throughout 'Lucy In The Sky With Diamonds'.

The Beach Boys

PET SOUNDS

Bassists: Carol Kaye, Ray Pohlman, Lyle Ritz

Brian Wilson was another refugee from touring and, like The Beatles, free to give 100 per cent to his next studio opus. He didn't fail to deliver, employing the LA 'wrecking crew' group of session musicians to lay down the bass on tracks such as 'Sloop John B', 'Don't Talk', and 'Wouldn't It Be Nice'. Carol Kaye's basslines on 'God

Only Knows', supplemented by an upright track laid down by Lyle Ritz *and* a Danelectro bass track by Ray Pohlman, show Wilson's love of the low-end was still very much alive.

Yes

THE YES ALBUM

Bassist: Chris Squire

Chris Squire has been the pivotal point in every variation of the Yes line-up. His wiry basslines are rarely copied, their unique melodic and tonal originality finding a perfect home in Yes's distinct brand of progressive rock. What McCartney did for the Hofner violin bass, Squire achieved for the Rickenbacker 4001. Many are still unaware that the instrument has tonal possibilities beyond the bright growl that Squire made famous.

The Who

THIRTY YEARS OF MAXIMUM R&B

Bassist: John Entwistle

As Led Zeppelin upped the ante of blues/rock, The Who took traditional rhythm and blues into a new realm. With the challenge of meeting Townshend's increasing stage volume, Keith Moon's flamboyant drumming, and Daltrey's stage presence, Entwistle, quietly (not literally – his on-stage volumes were legendary) developed his own bass style and sound. It started with the bass solo on 'My Generation' and went on to inspire many bassists, such as Billy Sheehan and Steve Harris from Iron Maiden. Entwistle died in 2002, but his tone and love of the bass remain inspirational.

Cream

STRANGE BREW: THE VERY BEST OF CREAM

Bassist: Jack Bruce

A greatest-hits package, but one that showcases the many talents of the world's first power trio, beating the Jimi Hendrix Experience by several months. With Jack Bruce handling vocal and bass duties, Cream are also the power trio that excites bassists more, Bruce standing equal to the vast talents of Clapton and Baker. Fusing classical, jazz, and blues influences, the bassist let rip on his Gibson EB-3 during the band's extended live improvisations, and embellished his blues-influenced riffs in the studio with chromatic and scale approaches for a unique sound.

James Brown

STAR TIME

Bassists: Bernard Odum, Hubert Perry, Jimmy Tyrell, Tim Drummond, 'Sweet' Charles Sherell, Fred Thomas, Doug Wimbish, William 'Bootsy' Collins

A common mistake is to associate James Brown solely with William Collins, otherwise known as Bootsy. Bootsy was featured on Brown's best-known hits, such as 'Sex Machine' and 'Super Bad', but that left a string of other numbers attributed to many forgotten bassists. *Star Time* is a great place to see that the funk stayed with Brown, regardless of who was behind him.

Various Artists

Hitsville USA: The Motown Singles Collection

Bassists: James Jamerson, Clarence Isabell, Tony Newton, Bob Babbitt, Eddie Watkins, Carol Kaye, Bill Pitman, Ron Brown, Wilton Felder

Just as *Star Time* dispels the myth that Bootsy Collins was the only player with James Brown, *Hitsville USA* shows that Jamerson was one of many players who set out the soul groove of Motown. And yet, when we study the most memorable hits, Jamerson's name emerges time and time again. 'My Girl', 'Ain't No Mountain High Enough', 'I'll Be There', and 'What's Going On' are all Jamerson classics. *Hitsville USA* also makes the perfect companion to the *Standing in the Shadows of Motown* book and CD package (see below).

Led Zeppelin II

Bassist: John Paul Jones

Bringing a studio savvy to Led Zeppelin's blues/rock sound, together with a personal respect for funk and Motown, John Paul Jones eschewed the typical triadic approach in favour of a slick, syncopated yet flowing bass style. Throw in John Bonham's thunderous drumming and you have one of rock's all-time greatest rhythm sections. 'Ramble On' reflects that approach perfectly, while the 'The Lemon Song' could work as an unaccompanied bass groove solo without Page's guitar.

The Red Hot Chili Peppers

CALIFORNICATION

Bassist: Flea

Blood Sugar Sex Magic started the Flea revolution, but part of his appeal is bringing the Chilis' energy to a fresh young audience, time and time again, and never more so than on *Californication*. Impossibly fluid 16th-note riffing on 'Around The World', energy-filled tasteful slapping on 'Get on Top', and perfect pop/rock accompaniment on 'Scar Tissue' show Flea in superb form.

Level 42

LEVEL 42

Bassist: Mark King

In the UK in the 1980s, no one did more for bass guitar than Mark King. It was impossible to visit a music store without the sound of 'Love Games' coming a rat-tat-tatting out of a Trace Eliot 4 x 10" combo from several directions. Although Larry Graham, Stanley, and Bootsy had slapped their basses many years earlier, King attached his to a jazz/pop fusion mix that reached more ears in his homeland.

Dave Lee Roth

EAT 'EM AND SMILE

Bassist: Billy Sheehan

Technique? That's for fusion players isn't it? Someone forgot to tell Billy Sheehan, who, together with guitar whiz Steve Vai, turned an album of potentially standard

rock tunes into a shred-fest. 'Elephant Gun' and 'Shy Boy' feature the two-hand tapping, flamboyant embellishments and crazy speed pentatonics that sent bassists back to their bedrooms – and had them buying sweat bands in their droves.

Japan
TIN DRUM

Bassist: Mick Karn

While most fretless players were content to become Jaco clones, Karn thrust forward his unique style and sound, most famously on *Tin Drum*, where the band's songs were at their strongest both commercially and musically. Check out the syrupy groove of 'Visions Of China'. No-one sounds like Karn – how refreshing.

Jaco Pastorius
JACO PASTORIUS

Bassist: Jaco Pastorius

For so many bass players and musical scholars, it almost becomes impossible to have a serious discussion of the history of bass without mentioning this record. With his debut album, Jaco took bass out of its previously ill-defined role as purely a support instrument. Lead lines, harmonics and jaw-dropping technique were about to be copied by bassists everywhere. As bassist Richard Bona said, "Nobody ever played that instrument before the way Jaco did."

The Stranglers
RATTUS NORVEGICUS

Bassist: Jean Jacques Burnel

The Sex Pistols' *Never Mind the Bollocks* changed musical attitude and style forever, but Burnel's bass playing had the greatest effect on the low-end community. His buzz-saw compressed basslines combine controlled aggression, arpeggios, and a pick technique full of dynamic energy. Overnight, it destroyed the notion that punks couldn't play.

Michael Manring
SOLILOQUY

Bassist: Michael Manring

If soloing on bass sounds challenging, imagine creating an entire career from performing solo on the bass guitar. Michael Manring has combined flawless, creative chops with melodic material to stand out from the crowd. Where necessary he has, like many musical masters before him, sought to further develop the electric bass to allow his music to evolve. His use of three octave necks and multiple D-Tuners is illustrated here.

Steve Bailey, Victor Wooten
BASS EXTREMES

Is it a CD? A book? A tutor? A backing track? It's all of the above. When two

technical exponents of the bass decide to record together, the end result is indeed extreme bass. Wooten performs on Fodera four-string and tenor basses, providing tapping, slapping, and flowing chicken-pickin' melodies, while Bailey slides and octave-drops on a six-string Aria signature fretless. It laid down the gauntlet for anyone thinking of performing a bass duet at their next clinic. As a CD and tutor-book combination (and DVD if you'd like to pick up on the guys' humour as well) it makes a great package.

Chic/Sister Sledge

GOOD TIMES: THE VERY BEST OF THE HITS & THE REMIXES

Bassist: Bernard Edwards

Disco? Oh yes, when it's laid down by the rhythm section of guitarist Nile Rodgers and bassist Bernard Edwards. Although we automatically lock onto the drums for our groove, a finely 'chopped' rhythm guitar should not be ignored. Rodgers and Edwards laid down the funk for many dance records, but most notably with Chic and Sister Sledge. The tunes were hits on the dance floor and with musos alike. Check out the melodic, yet simple riffing of 'Good Times', 'Le Freak', and 'I Want Your Love'. Perfect.

Alan Slutsky (Dr Licks)/Various Artists

STANDING IN THE SHADOWS OF MOTOWN

This book and double-CD package really had a profound effect on bass players; it told them who James Jamerson was. Many of us accept his name today as if we knew all along that he was the Motown bass player who came up with cool, melodic, flowing, and syncopated basslines. But the fact remains that prior to this publication, very few people knew the Jamerson legacy. The book studies Jamerson's style through non-original (but authentic) backing tracks of the hits Jamerson played on, together with basslines re-recorded by an A-list of bass stars: Marcus Miller, James Jamerson Jnr, Pino Palladino, John Entwistle, Dave Hungate, Anthony Jackson, Nathan Watts, Jack Bruce, John Patitucci... It's time this great publication was celebrated with the enthusiasm that greeted it when it was released in 1989.

RECOMMENDED BOOKS AND VIDEO

Things have changed in the bass tuition world, especially in the last decade with the widespread use of CDs, DVDs, and the internet. The challenge today is not the shortage of good study material, but trying to select the best of what is out there. There is still, unfortunately some poor quality material and the internet has proved to be both a blessing and a curse (it has a wealth of information but much of it is untrustworthy). This is not an exhaustive list of what to study; after all, honing your chops on the Bach Cello Suites probably won't help you nail a reggae bassline, but it is tried and tested by a good number of experienced bass players and students. Remember though, just have fun!

Reading Contemporary Electric Bass

AUTHOR: RICH APPLEMAN

If you want to become an accomplished reader, then you need to digest as much material as possible and avoid tablature like the plague. Rich Appleman takes the right approach here, with minimal guidance but lots of dots. You will need the information in *The Bass Handbook* if you are totally new to reading, but once underway, *Reading Contemporary Electric Bass* gives a variety of stylistic lines that will challenge your reading skills.

The Musician's Guide To Reading And Writing Music

AUTHOR: DAVE STEWART

An excellent straightforward guide to musical notation, aimed at rock and pop players. It covers all the basics and some more advanced topics. Also very funny.

The Slap Bass Program

AUTHOR: ALEXIS SKLAREVSKI

Let's get the disadvantages of this excellent video out of the way first. Firstly it is a video, not a DVD, and it seems there's no current option to purchase it in a more modern format. And it was made in 1988, so it looks a little dated today. This makes the content, delivery, and production even more impressive, in that it still ranks as an excellent guide to slap bass. From the simplest grooves to mindbending four-finger slap 16ths, it can help you at any level. If you want a visual guide to make your slap stand out, this is the one.

The Bass Bible

AUTHOR: PAUL WESTWOOD

Session player Westwood presents hundreds of different grooves in *The Bass Bible,* from straight rock to African beats. It's a highly comprehensive guide and examples are performed on two CDs that accompany the book. You probably won't study every example, but it's a useful resource for when you want to know what grooves are played in Cameroon.

The New Real Book

AUTHOR: CHUCK SHER

A collection of hundreds of jazz standards, the jazz influenced 'real book' takes many forms; copies are often illegal – ie, the composers get no royalties – and mistakes are often incorporated in the hurriedly transcribed scores. The Sher Publication version is legal, accurately transcribed and includes important additions such as sample bass parts where they are essential to the tune. No serious jazzer or improviser should be without one.

The Jazz Theory Book

AUTHOR: MARK LEVINE

From the same home as the Sher *The New Real Book*, *The Jazz Theory Book* takes scales, composition, harmony, and tune analysis to a new level of depth in a jazz setting. What makes the book stand out from the crowd is the range of examples; every theory point is backed up by reference to a jazz standard tune. An excellent reference book.

Level 42 Transcriptions Vol 1

AUTHOR: STUART CLAYTON

Stuart Clayton probably knows more about Level 42 bass player Mark King than any other thumbslinger on the planet. In fact, as Mark King doesn't read music, he knows more about Level 42 basslines even than the man they call Thunderthumbs. With over five volumes of basslines transcribed in rich detail, Clayton's first volume remains the most popular, covering King's most extravagant work from the band's earlier albums.

Charlie Parker Omnibook Bass Clef Edition

How many great players have offered the advice to learn the melodies of the jazz greats as a way to improve your bass voice? But how does one achieve this without hours spent transcribing? (That *is* of course the best method – if you have the time.) Those sax lines pass by pretty fast when played at 320bpm. One answer lies here, in *The Charlie Parker Omnibook*: a transcription, not of bass parts but of the melodies of the great saxophonist. It's a great workout in scales, triads, and approach tunes, all wrapped up in famous melodies.

The Funkmasters: The Great James Brown Rhythm Sections 1960-1973

AUTHORS: ALLAN "DR LICKS" SLUTSKY AND CHUCK SILVERMAN

Just as Allan Slutsky made an impact with his *Standing In The Shadows Of Motown* book, covering the Motown legend James Jamerson, *Funkmasters* carries on in a similar format, covering the bass players and drummers who accompanied James Brown. The format is slightly different here; only the main grooves are covered (the essence of the song anyway) and no big stars are playing the parts, but it still conveys the spirit of how to learn what made The Funk groove.

Bach: Six Suites For Violoncello Solo

AUTHOR: FRITZ GAILLARD

Billy Sheehan and Jeff Berlin are just two great bass players who have dug deep into JS Bach's vast catalogue to help their playing. The cello suites remain firm bass favourites because they are mainly covered by the bass clef range, and with just slight re-voicing work well on electric bass. It's like having all your favourite bass exercises wrapped up in six separate studies. For example, Suite I develops 16th-note sight-reading and fingerboard development, Suite II gives a great bass chord workout, and Suite III features wide interval leaps. It just proves that even in 1720 there was a great bass player.

The Bass Book: A Complete Illustrated History Of Bass Guitars

AUTHORS: TONY BACON AND BARRY MOORHOUSE

After publication upon publication focusing on the electric guitar, giving bass at best a passing mention, or perhaps even a whole chapter, it was a welcome relief to find *The Bass Book* on the shelves of many bass specialist shops. Although the title is now a little dated and in the original Balafon Books smaller A5 format, its layout, bass-only emphasis, and detail make it the perfect coffee table reference guide. Not only are important historical basses photographed, many are the instruments of superb players. They include Pino Palladino's fretless Music Man, Guy Pratt's Fender Jazz Bass, and McCartney's 500/1 Hofner.

The Jazz Bass Book

AUTHOR: JOHN GOLDSBY

In *The Jazz Bass Book*, Goldsby paints an accurate picture of the development of the bass in the jazz age, finding colour in his descriptions of the pivotal jazz bassists. Included in these histories are transcriptions of the key developments that each player contributed to the music. The transcriptions are backed up by the examples on the accompanying CD, which is full of performances by Goldsby's excellent trio. The author also identifies key recordings for each bass player, leading you to some interesting listening. On top of this the author explains some fundamental aspects of bass playing such as scales, arpeggios, developing basslines, rhythm patterns, bowing techniques, and even developing a 'concept', one of the abstract and profound elements of music that is more challenging to get across.

The Beatles Complete Scores

AUTHORS: TETSUYA FUJITA, YUJI HAGINO, HAJIME KUBO, AND GORO SATO

Featuring every commercially available Beatles track, including b-sides, up to the point of publication in 1989, this 1,100-page anthology features the complete score to every Beatles song. Basslines are accurate (although they miss some moments of McCartney magic when for space reasons repeats are used during fade out sections) and presented in TAB and notation. The only criticism is the small print size to allow all the instrumentation to fit the page.

The Essential Jaco Pastorius

AUTHOR: SEAN MALONE

One of three Jaco books released by Hal Leonard to promote Jaco's legacy, the *Essential* volume contains the best selection of material if you opt to purchase just one title. With 'Birdland', 'Blackbird', 'Come On Come Over', 'Teen Town', and 'Continuum' being just some of the highlights, you know you are in for a Pastorius shredding fest.

Jaco The Extraordinary and Tragic Life of Jaco Pastorius....

AUTHOR: BILL MILKOWSKI

Another Jaco book, but this time a fascinating and thought-provoking insight into the man himself. Whilst the legendary Jaco tales appear throughout the book, Milkowski also reveals the gradual decline of Pastorius's mental health that caused so many of these headline-grabbing incidents. Milkowski's book has many interviews with those who knew the real Jaco and a detailed discography. The new 2006 edition contains more photos and a bonus CD of early Jaco material.

Bass Tab White Pages

AUTHORS: VARIOUS

A simple but great idea. Collect 160 tunes from classic rock to metal and put them into one book with the bass parts transcribed in notation and tablature. After busking through 'Manic Depression', 'Birdland', 'Back in the U.S.S.R.', 'New Year's Day', 'Give It Away', and a dozen other tunes I still had Earth Wind & Fire, System Of A Down, Led Zeppelin, Buddy Holly, Aerosmith, Yes, Limp Bizkit, and about twenty other bands to consider. Whilst not every detail of every bass part is covered, there's so much on offer here it would rank as one of the best value pieces of bass 'kit' you can get your hands on. Ideal for study, students, busking, depping, and much more.

ACKNOWLEDGEMENTS

I am indebted to John Paul Jones, who kindly wrote the foreword to my book and has supported many of my bass-related projects.

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Joel McIver provided large and informative chunks of the fretless bass chapter in his usual excellent style, while Duncan Boniface of Carlsbro Electronics Ltd provided superb technical writings regarding bass loudspeaker design. The bass strings chapter would not have been achievable without the input from Mike Brooks, and Evan Skopp from Seymour Duncan provided a concise account of replacing a pickup. Thanks, chaps.

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Of course this book would not have been possible without the enthusiasm and professionalism of the entire Backbeat UK team, especially Nigel Osborne, Tony Bacon, and John Morrish.

My parents Richard and Renate Ashton gave me wit and wisdom, essential companions for the writing of this book.

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CD TRACK LISTING

In recording the CD for The Bass Handbook, I wanted to let you hear the sound of some of the basses featured in the Hardware section. For the Reading Music section, I used the Gibson EB3 (p24). I mainly used the bridge pickup or both pickups, but sometimes I employed just the neck humbucker. Its sound is immediately obvious; deep, warm, and with no top end. Exercise 163 was recorded with the Fender 1966 Jazz Bass (p13), while the slap section benefited from the bright, percussive sound of the Music Man StingRay (p35). For the remainder and majority of the CD I used my trusty companion of many years, a Manson Guitars Classic J fitted with passive Bartolini pickups. All recording was done directly into the desk with no EQ or compression added.

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TRACK 88 Riff, palm muted, with phaser
TRACK 89 Riff, palm muted, with compression

Recorded at The Linney, Shaldon by Ian Loud.
Basses: Adrian Ashton.
Guitars: Jason Morris, except 'Jazz Blues Performance' by Dave Stephens
Drums: Gary 'Gadge' Evans.

The Bass Handbook

The electric bass guitar is central to modern music, playing a key role in melody, harmony, and rhythm. This book and CD package will help you master the instrument and make it your own. It includes:

- a step-by-step guide to playing, from tuning-up to advanced harmony
- practical guidance on reading both tab and standard notation
- instruction in modern techniques including slapping and harmonics
- advice on playing a range of genres and styles, from rock and blues through to jazz, funk, and metal
- a CD of the book's key musical exercises and examples
- a history of the instrument and its makers
- a guide to the great bassists, plus recommendations for listening, reading, and viewing
- help with buying and maintaining your bass
- advice on amps, speakers, strings, pickups, and cables

Author Adrian Ashton has 20 years of experience as a player, teacher, and writer. A graduate of the Bass Institute of Technology in Los Angeles, he was the founding editor of the UK's *Bass Guitar Magazine*.

This book is essential equipment for any bassist, whether you are just starting out or hoping to take your skills to a higher level.

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