Bicycling illustrated
Maintenance Manual

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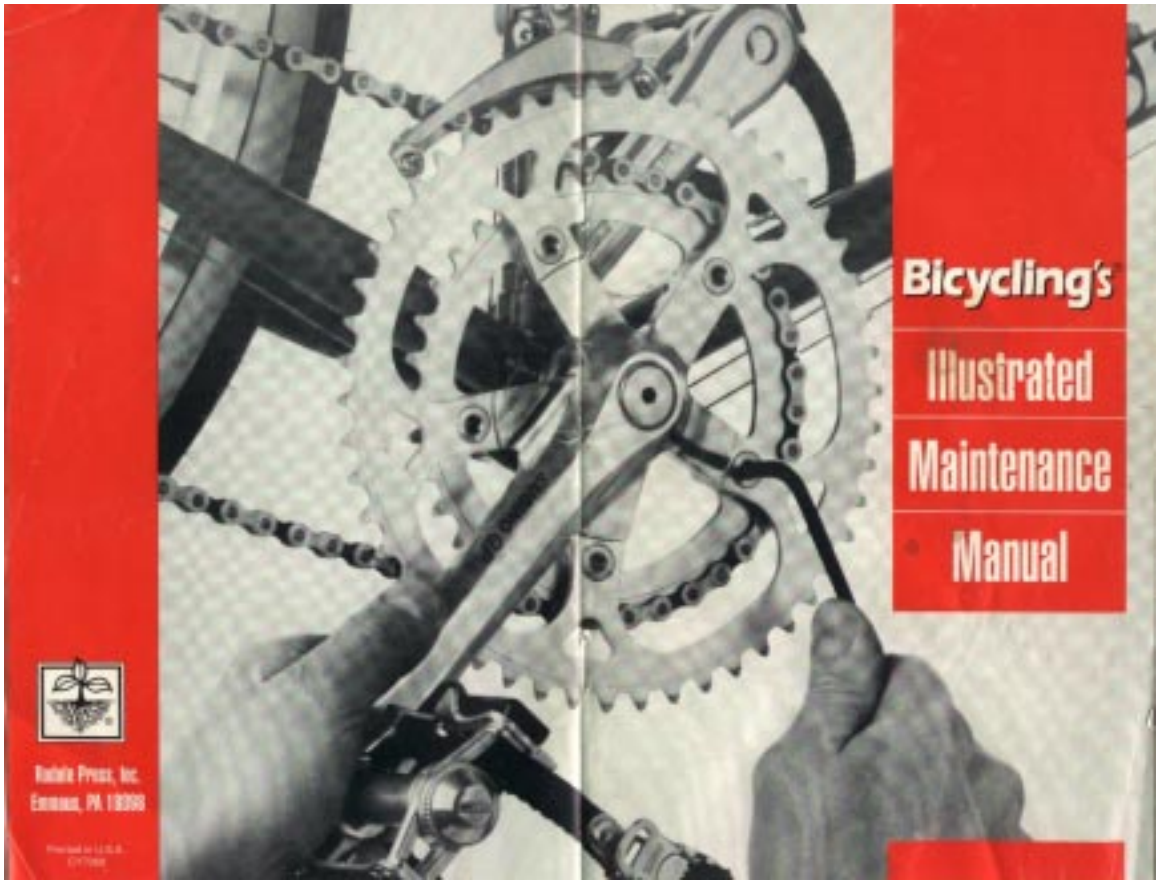
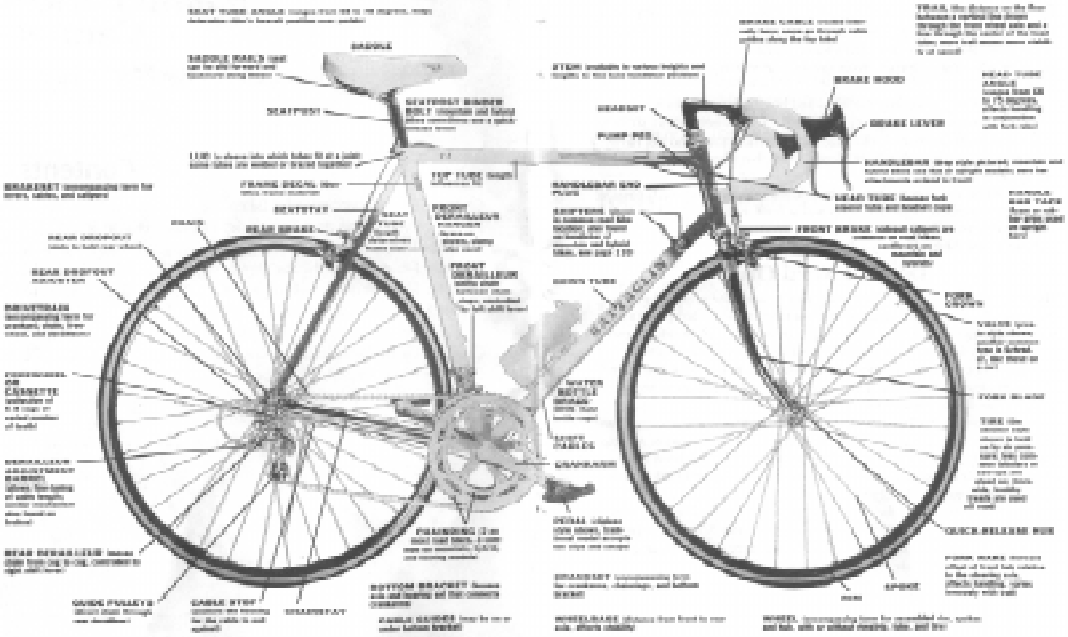


Chapter One

Anatomy of a Bike

58 Parts, Measurements, & Tech Terms You Should Know

By Bill Strickland Photography by Donna Chiarelli



Chapter Two

Tools and Tips to Set up Your Home Shop

By Jim Langley Photography by Henry Ding

I know 3 couples who enjoy bicycle repair so much that they rent a 500-square-foot storage space for $100 a month to use as a workshop. It has plenty of space for their tandem, mountain, and road bikes — all 17 of them.

"Every winter we strip the bikes and build them up from the frame," says Tammy Graham of Yuba City, California. "Some weekends all six of us will spend hours down there cleaning parts, polishing tires, and just having a good time." Sometimes they'll fix friends' bikes, but always because they like it, never for profit.

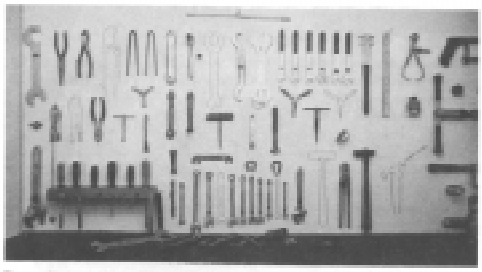
While you may not take to bicycle maintenance with such passion, a properly equipped, organized shop will at least make it enjoyable. A home work area will also save you money, and the knowledge you gain will add a new dimension to your cycling.

Do You Need One?

The more bikes you own and the more they're used, the greater the benefits. Most bike shops base charges on labor rates of $40 to $65 per hour, so it won't take many do-it-yourself repairs to defray the cost. In this chapter we detail complete setups costing $450 or more, but you can proceed piecemeal, buying only those tools you know how to use. Plus, you may already possess many common items such as screwdrivers, pliers and wrenches, reducing the total to $150 or less.

Of course, having the tools doesn't guarantee that you'll perform flawless work, but basic repairs require only average mechanical skills. An illustrated manual can be invaluable, and we recommend the updated version of *BICYCLING's Complete Guide to Maintenance and Repair* (1994, Rodale Press, $16.95 softcover, $24.95 hardcover).

If you don't have the space or money to create a shop, call local bike stores to see if they provide customer repair areas. Sometimes there's a fee, but you'll probably still save money. What's more, if something goes wrong, shop personnel are close by to help.



The author's tool board is made from a 4x8-foot piece of ¾-inch plywood. He traced the tools on a cardboard template and drove nails into the outlines. Then he removed the cardboard and hung them again on the plywood.

Shop Environment

Select an area large enough to provide working space around the bike and room for a workbench and shelves or a table. (Your bench will be constantly cluttered if it's the only place to put things.) Secure rubber-coated storage hooks into the rafters for extra wheels and bikes.

Slag rags or wood floors with cracks can hide small parts. A light-colored, stain-resistant surface is best. Another good option is an indoor/outdoor carpet. It supplies some cushion and can be washed or replaced when dirty. Ensure adequate overhead lighting.

Some building supply stores sell workbench kits, but you can make a sturdier one for less. If you have space, build an 8x2-foot bench that's 34 inches high. (Smaller surfaces will work, too, but tend to become cluttered.) Use 4x4-inch legs and 2x4-inch cross braces. Build a storage shelf on the bottom for a tool box, trash can, and extra parts.

Your tool board should be a 9x84-inch piece of ¾-inch plywood. (Pegboard can be used, but requires mounting hardware that can limit your tool arrangement.) Use a large piece of cardboard as a template. Place it on the floor and trace the outline of your tools on it, arranging the most frequently used ones in the center. Place the template against the board, and drive finishing nails in the outlines to support the tools. Remove the template, hang the tools, and trace their outline on the board with a black marker (see photo). Make a screwdriver and allen wrench holder by drilling holes in a short 2x4-inch piece of wood and attaching it to the tool board.

Repair Stands

Pro mechanics wouldn't think of working without a good repair stand that elevates the bike and allows the wheels to spin. Better stands let the bike rotate, too.

Blackburn, Cinelli, Cycle Pro, Minoura, Park, and Yakima are a few makers. Generally, stands costing less than $75 are less stable and adjustable, but easy to portable. More expensive stands are usually durable, fit more tubing diameters, allow different methods of grasping the bike, and provide enough stability to lug and pound. Park Bicycle Tool Company sets a high standard for repair stands, and they're almost universally used in bike shops. Park's PCS-1 (about $105) is a portable model that's ideal for home use.

If you don't have enough space for a floor stand, consider the less expensive bench- or wall-mounted models that are available from most makers. Their limitation is that you must reverse the bike to get full access.

Tools

Basic repairs require household tools plus a few specialty items available at bike shops. Don't outlade used hand tools — you'll find good deals at flea markets, swap meets, and yard sales. Otherwise, visit a hardware store. Basic cycling tools are available at shops (some items may need to be ordered), or from mail-order companies. But for the largest selection, write for a free catalog from The Third Hand (Box 212 B, Mt. Shasta, CA 96067). It sells Campagnolo, Homer, Minoura, Park, Stein, Var and Wheelsmith tools, as well as repair manuals and instructional videos.

See the list of tools included for the basic, intermediate and ultimate home shops. The basic set will enable you to complete most routine repairs. The intermediate group will enable you to change cogs and try other tasks. The ultimate group is sufficient for any job. You'll also need grease, spray lube, wax, electrical tape, cutting oil (if you plan to tap or chase threads), and thread adhesive.

When possible, use rags to clean parts rather than solvents. Otherwise, use biodegradable degreasers (available at hardware stores, bike shops, or through mail-order catalogs). Kerosene is inexpensive and readily available, but requires rubber gloves and adequate ventilation. All solvents should be kept in clearly marked containers and disposed of in an environmentally sound way. (Consult the blue pages of your phone book.)

Home Shop Tools

Basic ($450)

General tools:

- Phillips screwdrivers (small, medium)
- flat screwdrivers (small, medium, large)
- regular pliers
- channel-type pliers
- needle-nose pliers
- vise-grip pliers
- diagonal cutter
- allen wrenches (4-, 5-, 6-mm)
- combination wrenches (7- through 17-mm)
- adjustable wrenches (6-, 12-inches)
- eight-ounce ball-peen hammer
- plastic mallet
- scissors
- tape measure (in centimeters and inches)
- hacksaw

Bicycle tools:

- BICYCLING's Complete Guide to Maintenance and Repair
- floor pump with gauge
- repair stand
- tire levers
- pedal wrench
- cone wrenches (usually 15- and 16-mm for front and rear hubs, respectively. Two each.)
- Schrader valve core remover
- cable cutter
- third-hand tool or toe strap (for brake cable adjustments)
- chain rivet extractor
- freewheel remover (for your brand)
- spoke wrench (to fit your wheel)
- crankarm bolt wrench (or chainwhip and torque wrench)
- crankarm puller
- bottom bracket tool set (fixed-ring and fixed cup spanners and pin tool)
- headset wrench (usually 32-mm)

Intermediate ($750)

Includes all basic tools, plus:

- Sutherland's Handbook for Bicycle Mechanics (Sutherland Publications, Box 9061, Berkeley, CA 94709)
- truing stand
- Stein fixed cup wrench clamp
- freewheel vise and chain whips (for changing cogs)
- small needle-type grease gun (for lubricating parts with grease holes or fittings)
- Park tool

Ultimate ($1,800)

Includes all basic and intermediate tools, plus:

- dishing gauge (for building wheels)
- spoke tensiometer
- dropout alignment tool
- headset cup press (for headset installation)
- derailleur hanger alignment tool
- rear wheel/gear alignment indicator bar
- electric drill and bits
- grinder with wire and buffing wheels
- air compressor with blower attachment
- metric set (4-inch)
- solvent tank
- rubber gloves
- Vernier caliper
- metric taps (5 mm x 0.8-mpt and 6 mm x 1.0-mpt)
- medium and coarse files

Chapter Three

The 30-Day Checkup

By Jim Langley Photography by Mel Lindstrom

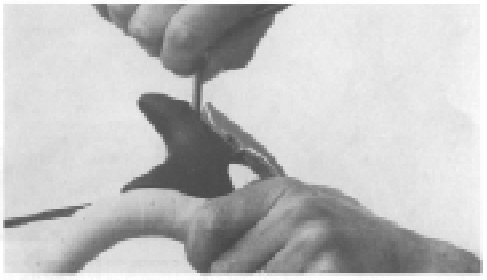
Tools and Supplies:

- repair stand
- 4-, 5-, and 6-mm allen wrenches
- screwdrivers
- headset wrenches
- cone wrenches
- pump
- spoke wrench
- pedal wrench
- crankarm dustcap remover
- crankarm bolt wrench
- bottom bracket locking spanner
- Park TPH-1 adjustable tap pin tool
- Park or Bicycle Research derailleur tool
- chain tool
- pliers
- spray or drip lube

After a month's use, new bikes require a tuneup to correct break-in problems such as stretched cables, loose spokes, and components that are out of adjustment. In order not to void the manufacturer's warranty, this free checkup should be done by an authorized dealer. Then, should something break during normal use, the shop will honor the guarantee, knowing that the bike was properly maintained.

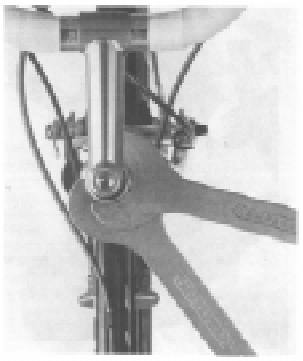
As a former service manager, I know that many new bikes never receive this important checkup. People move, stop riding, or simply forget. For whatever reason, the bike goes unserviced, which leads to premature wear and breakage.

If you can't take advantage of your free tuneup, or if you assemble the bike yourself and aren't entitled to one, here's how to do it. This procedure is also useful one month after a major overhaul in which numerous components were rebuilt or replaced.



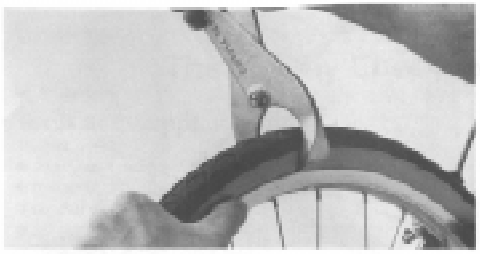
1. Handlebar and levers: While facing the bike with the front wheel between your knees, try turning the handlebar sideways with moderate force. It shouldn't move. Then try twisting the bar in the stem. If necessary, align the bar and tighten the stem bolt(s) with the appropriate allen wrenches.

Push on brake and mountain bike shift levers with your palms to check tightness. If they move, align them and tighten their clamps. All shop bar and stem bolts have an internal clamp bolt. To reach it, open the brake quick-release, compress the lever handle and insert a screwdriver or allen wrench (photo). Be careful not to damage the paint.



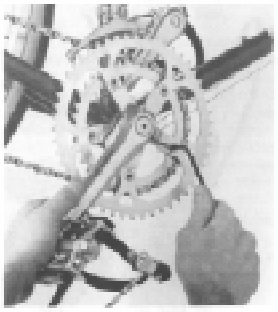
2. Headset: Stand next to the bike and apply the front brake. Rock the bike fore and aft to feel for smoothing, which indicates a loose headset. Another way is to lift the front end a inches and drop it, listening for looseness.

Remove play with headset wrenches by loosening the locknut, then turning the cone clockwise ¼ of a turn. Now tighten them against each other (photo) after removing the locknut shown. To check the adjustment, place the bike in a repair stand, remove the front wheel, and turn the fork slowly by hand. It should rotate without roughness, and there should be no play if you push and pull on it.



3. Wheels: Open the brake quick-release, remove the wheels, and check the nuts quick-release. Grip one end of each axle and move it up and down to feel for bearing play. Also, hold each wheel by its axle locknuts and try to unscrew them. If necessary, use cone wrenches to adjust the bearings and tighten the parts on each side against one other. (See Chapter Ten, "Overhauling Hubs.")

Inflate the tires to the pressure recommended on the sidewall and inspect the beads for seating problems. (The bead line should be concentric with the rim.) Add pressure to seat rims if a portion of the bead dips below the rim. If this doesn't work, use a tire-seating tool (made by Park or Bicycle Research) to grasp the rim and pull it up (photo). Install and center the wheels. Wiggle each spoke to check for looseness, and use a spoke wrench to tighten and true the wheel if necessary.

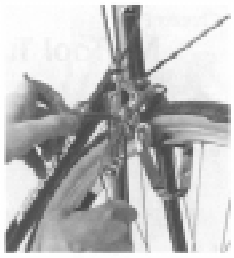


4. Crankset and pedals: Check pedal tightness with a wrench. If the axle opposite the drivetrain is loose, threaded (1) tighten toe clip bolts and inspect straps for damage. Unscrew cranksm dustcaps and tighten the bolts underneath. Tighten chainring bolts with a 5mm allen wrench (photo).

Test for bottom bracket play by grasping each crankarm and pushing and pulling sideways. If there's play, use the Park SPA-1 adjustable-cup pin tool and the lockring spanner to adjust the bottom bracket. If there's no play, test lockring tightness by trying to turn it clockwise with the spanner.

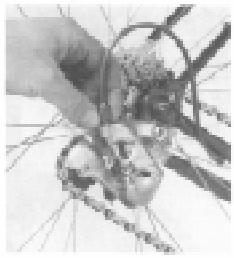
5. Brakes: With the appropriate wrench, make sure each caliper is tightly attached to the frame. Check pad alignment, and adjust and tighten as necessary, lubricate the caliper pivot points.

Operate the brakes to check for smooth action. The pads should rest about ¼ inch from the rim. If clearance is excessive, tighten the adjustment. For a minor change, turn the adjustment barrel on the caliper, lever, or hanger counterclockwise half a turn at a time and check progress. For a major adjustment, clamp the caliper with a third-hand tool, loosen the cable anchor, pull slack from the cable with pliers (photo), and tighten the anchor.

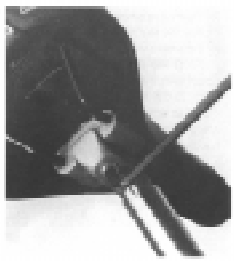


6. Derailleurs: Check attaching bolts with a wrench and lubricate the pivot points and chain. Shift both derailleurs repeatedly, watching for misshifts. Listen visually stretch slightly which causes sideward rear derailleurs to hesitate when shifting to larger cogs. Tighten the cable by turning the adjustment barrel on the back of the derailleur counterclockwise half a turn at a time (photo) and it shifts into each gear quickly.

If there is more water slack in the front derailleur cable after you shift to the small chainring, loosen the anchor bolt, pull the cable end with pliers, and tighten the bolt.



7. Finishing the job: Carefully tighten accessory mounting bolts (rack, computer, saddle wedge, etc.). Clean the frame with a soft, damp rag. With the bike on the ground, try turning the bars sideways and rocking it up and down. If necessary, tighten the seatpost binder bolt and seat clamp (photo) after making sure the seat is level. Finally, ride the bike to check shifting and braking, and readjust if necessary.



Chapter Four

No-Tool Tube Replacement

By Jim Langley Photographs by Mel Lindstrom

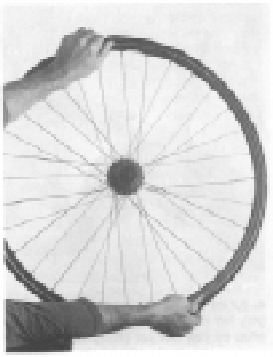
Required Items:

- spare tube
- pump

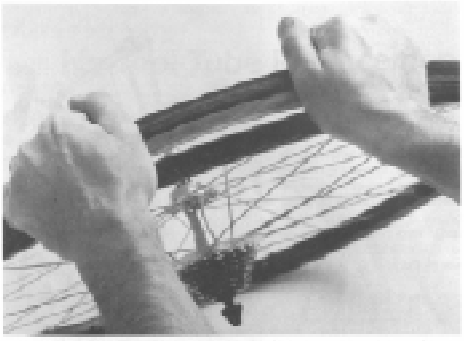
1. For rear flats, pedal by hand and shift the chain to the smallest freewheel cog. If there's a dirt on the inside of the driveway, lift the chain onto it with one finger. Open the basic quick release. On sidepull brakes it's found either on the lever or caliper arm. To release centerpull and U-brakes, squeeze the pads to the rim with one hand and disconnect the transverse cable with the other.

3. Open the wheel quick release. To free the rear wheel, lift the bike by the saddle with one hand while pushing the wheel forward and down with the other. If the chain clings to the freewheel, shake the wheel to dislodge it. Front wheels will drop out once the quick release is loosened.

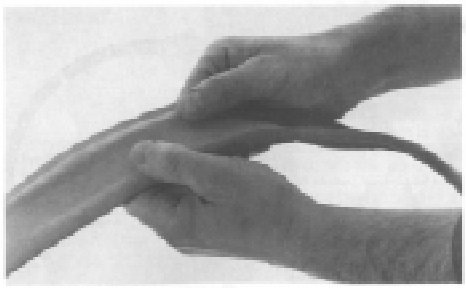
2. Lay the bike on the ground on its left side, or, for rear flats on most bikes, stand it on its front wheel and handlebar. Do this by lifting the back of the bike until the down tube contacts the brake caliper arm. You may have to pull the rear brake lever back slightly.



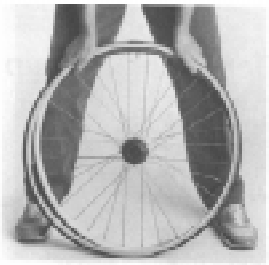
4. Remove the valve cap and valve nut, (if so equipped). Remove the tire by pinching a section opposite the valve stem with both hands placed side by side. Squeeze hard and roll the tire outward over your thumbs. Hold the tire in this pinch with your weak hand, and work around the tire with your strong hand, squeezing it so the beads move to the center (deep) section of the rim. As you do this, pull up on the tire with your opposite hand to create slack and ease removal.



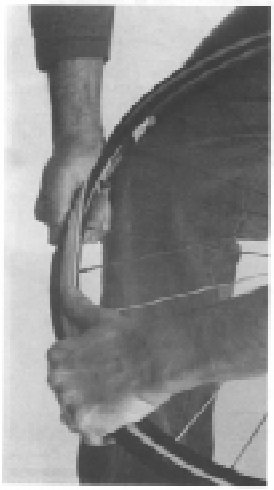
3. While maintaining your grip with the weak hand, rest the wheel on the ground. Place your free hand next to the other and maintain grip on the tire. Now lift with both thumbs and push the tire off the rim with the heels of your hands. If it resists, repeat Step 4 to increase lube.



4. Pull the tube from the tire and stuff it in your jersey pocket or seat bag. Look and gently feel inside and outside the tire for embedded sharp objects and remove them. Inflate the new tube just enough to round it. Press valve inside. Can be inflated sufficiently by blowing. Place the valve inside the tire.



7. With the wheel resting against your shins and the valve hole on top, place the portion of tire/tube with valve stem on the rim. Push the bead nearest you inside the rim and insert the valve stem partially into the hole. Pushing down against the ground, work the rest of the bead onto the rim, moving your hands away from each other around the wheel. Lift the wheel to push the last bead portion into place.



8. Install the tube completely into the tire, avoiding kinks and folds. With both hands moving away from the valve stem around the wheel, push the second bead onto the rim. To get the last eight inches on, pick up the wheel so the outboard section is at the top, facing you. If necessary, rest the wheel on your knee. Deflate the tube completely and roll the bead onto the rim with the heels of your hands. If it resists, pinch the beads together around the tire as in Step 4 to create slack. Or, check that the metal base of the valve stem isn't trapped between the beads. Push up to free it, then pull down.

Inflate the tire and install the wheel. Re-route the shift lever to fully forward, the chain is on the smallest cog, and the wheel is centered in the frame. (The axle may slide into the dropout slots easier if you pull back the derailleur with your hand.) Lift the chain off the chain peg if you used it, and close the brake quick-release.

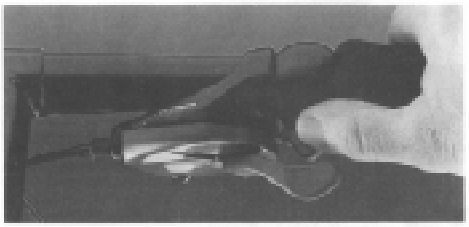
Chapter Five

Rear Derailleur Tuneup

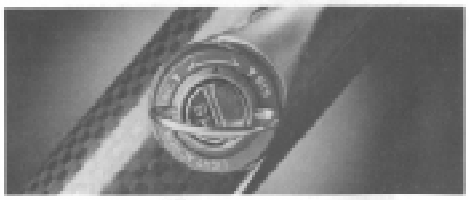
By Jim Langley Photography by Mel Lindstrom

Required Tools:

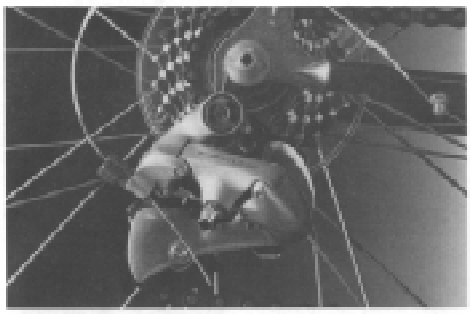
- repair stand
- allen wrench (4-, 5-, or 6-mm)
- grease
- diagonal cutters
- pliers
- small screwdriver (flat or Phillips)
- cable end cap



1. Place the bike in a repair stand. While pedaling by hand, shift the chain to the smallest freewheel cog and middle or smallest chainring. Downtube lever should be completely forward and top-mount thumbshifters fully back. With underbar levers, push the upper one 5 times. For Shimano DuraAce ST models, push the inner lever 7 times.

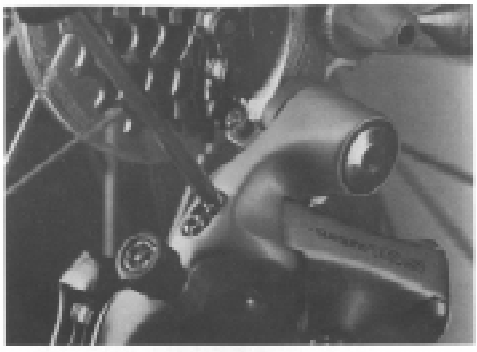


2. If possible, place the lever in friction (non-index) mode. On most DB8 WRT Omni-tube shifters this is done by turning a O-ring. Thumbshifters usually have a screwed small cover for the purpose. (Look for directions on the shifter body.) Underbar and DURA-ACE ST models can't be switched.

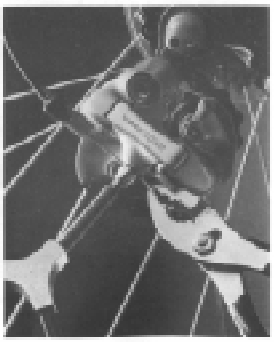


3. Cut off the end cap, loosen the anchor bolt, and release the cable. If it's kinked or frayed, replace it. Grease sections that run inside housing and reroute the cable to the anchor bolt. Turn the derailleur adjustment barrel clockwise all the way, then unscrew one turn. Don't tighten the bolt yet.

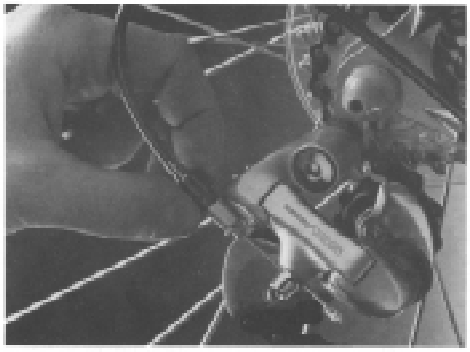
4. While pedaling with your right hand, push against the derailleur body with your left thumb, causing a shift to the largest cog. Release it to shift to the smallest cog. Do this repeatedly, noting any resistance or overshifting.



5. If necessary, adjust the derailleur's range of motion by turning the high- and low-gear limit screws (usually the top and bottom, respectively) to allow the derailleur to shift easily to the largest and smallest cogs. Counterclockwise turns allow it to move farther; clockwise turns limit it.



6. With the chain on the smallest cog, grasp the cable with pliers and pull tightly to remove slack. While holding the cable tightened, loosen the anchor bolt. Install the cable end cap and crimp it in place with daisy-cutter pliers. While pedaling with your left hand, shift repeatedly with your right to test adjustment. The chain should engage the largest and smallest cogs accurately. If necessary, adjust the limit screws. If the chain doesn't drop to the smallest cog despite adjusting the limit screws, you may need to add cable slack by turning the adjustment barrel clockwise half a turn. Otherwise, remove slack that's developed by pulling the cable through again.



7. Switch to index mode (if applicable). While pedaling with your left hand, move the lever one click with your right. The chain should jump to the next smaller cog and run quietly. If it hesitates, screw the adjustment barrel counterclockwise one half turn and retry. If it overshifts, screw clockwise by half turns. Shift through all the gears and test ride the bike. Fine-tune again if necessary.

Chapter Six

Front Derailleur Tuneup

By Jim Langley Photography by Mel Lindstrom

Required Tools:

- repair stand
- 4-, 5-, 6-mm allen wrenches
- small screwdriver
- pliers
- 8/9-mm combination wrench
- diagonal cutters
- spray lube
- grease
- cable end cap

You may also need:

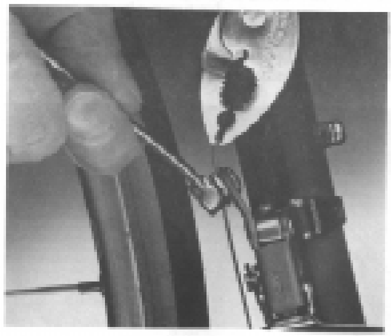
- bottom bracket locking spanner
- bottom bracket adjustable cup pin tool
- crankarm puller and fixing bolt wrench

1. Gripping each crankarm with one hand, push and pull laterally to check for play in the bottom bracket. If necessary, use the locking spanner and pin tool to remove play. (You may first have to remove the left crankarm with a fixing bolt wrench and puller.) Use the 5-mm allen wrench to tighten the left crankarm bolt.

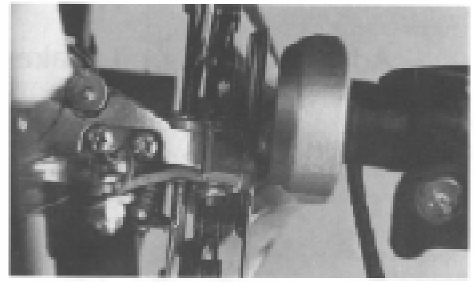
2. Lift the chain off the smallest chainring and place it on the bottom bracket. Turn the crank by hand while looking at the chainrings from above. Using one side of the front derailleur cage as a reference, observe the clearance of each ring. If they wobble, have shop personnel true them. Place the chain back on the ring. Next remove the cable end cap, loosen the anchor bolt with an allen wrench, and remove the cable from the housing (if applicable). Inspect it (cable) or replace it (frame) as necessary. Run the new cable through the lever, removing (or freeing) the frame's cable guide, and stops to the anchor bolt. Don't tighten it yet. Apply spray lube to the derailleur pivot points and wipe off the excess. Check the tightness of the cage bolt with a screwdriver.

3. When viewed from above, an imaginary line through the center of the derailleur cage should be parallel to the chainrings. Here, look at the derailleur and ring from the side. Pull the cage outward with your hand. It should clear the large ring by ⅛ inch. If necessary, loosen the frame clamp with an allen wrench and adjust derailleur position.

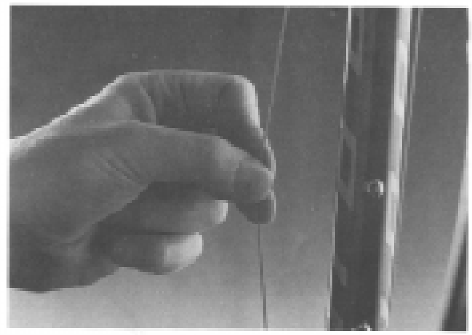
4. Shift to the largest freewheel cog and smallest chainring. Adjust the low-gear (inboard) limit screw so there is [illegible] inch clearance between the inside of the inner cage plate and the chain. Clockwise turns limit derailleur travel, and counterclockwise turns increase it.



5. Make sure the front shift lever is in its starting position. (Push downtube levers forward and turn thumbshifters counterclockwise. Return underbar levers and Shimano Dual Control models by pushing the small lever repeatedly.) Pull lightly on the cable with pliers to remove slack and tighten the anchor bolt with a wrench.



6. Shift to the largest ring/smallest cog combination. Adjust the high-gear (outboard) limit screw so there is at least [illegible] inch clearance between the inside of the outer cage plate and the chain. Also, the cage shouldn't travel outward so far that it strikes the crankarm.



7. Test by shifting repeatedly. Move the lever forcefully to stretch the cable, then shift to the smallest ring and check cable slack (as shown). Remove slack if necessary as described in Step 5. Go for a test ride. If overshifting occurs (the chain falls off), tighten the appropriate limit screw half a turn at a time and test. If shifts are hesitant, loosen the appropriate limit screw half a turn at a time.

Chapter Seven

Adjusting Sidepull Brakes

By Jim Langley

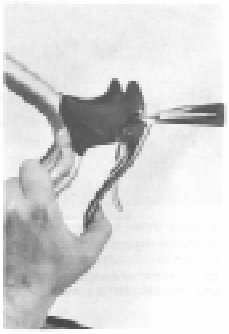
Photography by Mel Lindstrom

Required Tools/Supplies:

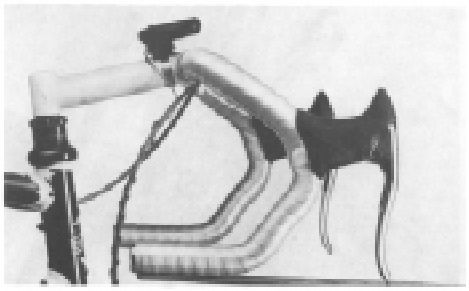
- repair stand
- 4-, 5-, and 6-mm allen wrenches
- 8-, 9-, and 10-mm combination wrenches
- cable cutter
- diagonal cutter
- cable end caps
- pliers
- flathead screwdriver
- *needlenose pliers*
- *derailleur tool*
- Park CBW-1 or CBW-3 offset brake-centering wrench
- grease
- spray or drip lube
- acetone

You may also need:

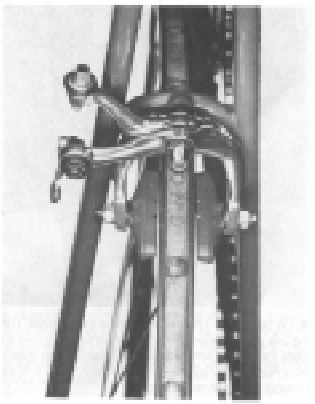
- cone wrenches
- spoke wrench
- adjustable wrench
- handlebar tape
- brake pads
- brake hoods
- cables and housing



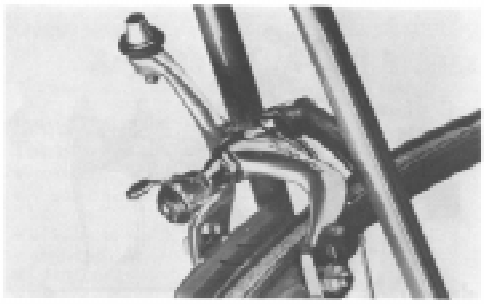
1. Before you start, feel for hub bearing play by grasping each rim and trying to move it laterally in the frame. If necessary, remove the wheels and adjust the bearings. (See Chapter Two, "Overhauling Hubs.") Wiggle each spoke to check tension and tighten as necessary with a spoke wrench until the wheels are true. Make sure both wheels are centered in the frame. (Note: Tom Kiser laces removed to enhance photography; it isn't necessary for these procedures, though it might help some situs.) Then remove the cable end caps and loosen the anchor bolts. Extract the cables from the housing and grease them. For easy brake levers, grasp each cable head with needlenose pliers, pull the cables partially out of the levers, and grease them. Remove rusted or frayed cables and cracked housing.



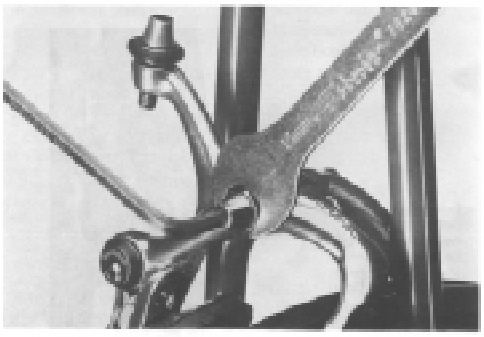
2. Make sure the levers are correctly positioned and tight on the handlebar. (A straight-edge placed under the flat portion of the bar should just touch the lever tip.) Apply spray lube inside the levers. Rewrap the bar if necessary. (See Chapter Eight, "Wrapping a Handlebar.") Replace cracked or worn brake hoods.



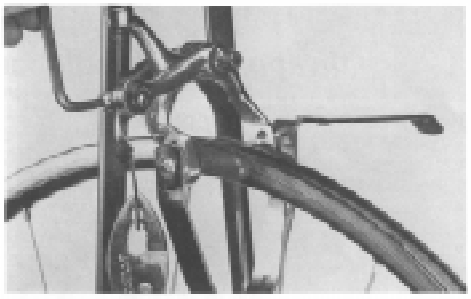
3. Replace old or worn brake pads. (Grooves should still be visible on the pads' faces.) Adjust new ones to strike the rim squarely, and tighten. "Toe" them slightly by gently bending the carrier arms with an adjustable wrench or by using the conical washers on some brake pads. The front of the pads should strike the rims first.



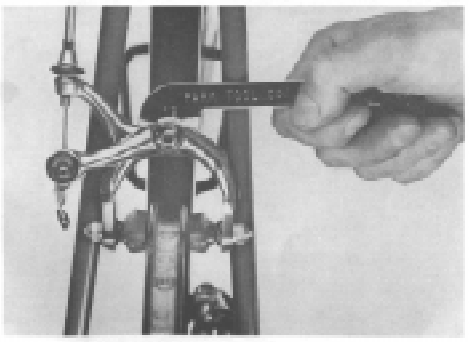
4. Unscrew the brake adjustment barrels, grease their threads, and screw them down entirely. Apply oil and lube on the caliper pivot bolts, brake spring tips (behind arms), quick-release, and anchor bolts. Tighten the brake attaching nuts or recessed allen bolts.



5. On brakes with 2 nuts on the front of the pivot bolt, check for caliper play by gently pushing and pulling the arms fore/aft. If there's play, remove it with the appropriate 2 wrenches. Make sure the adjustment allows the brakes to snap open easily from spring tension and that the 2 nuts are tight against each other. Apply lanolin to a rag and clean both rims thoroughly. Avoid getting on tires (it insulates).



6. Attach the treatment tool to hold the cable closed. Install new housing if necessary, and grease and lubricate cables. Thread them through the anchor bolts. Pull the end of each cable with pliers to remove slack and tighten the anchor bolts. Install cable end caps.



7. Unlatch and test the cables by squeezing the brake levers on the bar repeatedly. If necessary, replace Step 6 to remove slack. When done, there should be ½ inch clearance between the front of each pad and the rim. Use the appropriate Allen tool or a cone wrench to center the brake. Test ride the bike and apply the brakes several times, listening for squealing. If noisy, toe-in may not be sufficient.

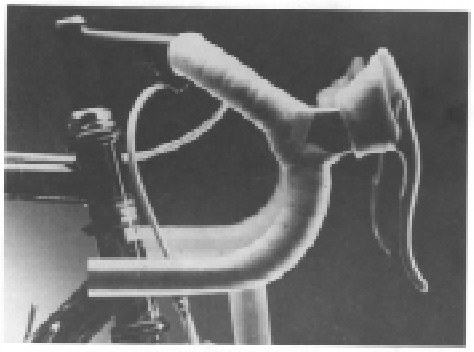
Chapter Eight

Wrapping a Handlebar

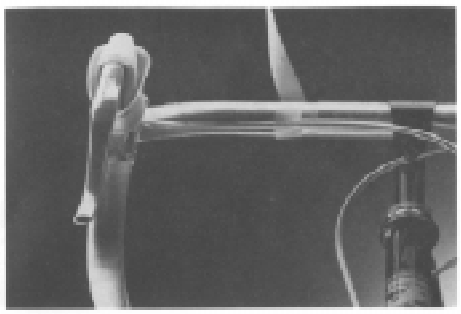
By Jim Langley Photography by Mel Lindstrom

Required Tools and Supplies:

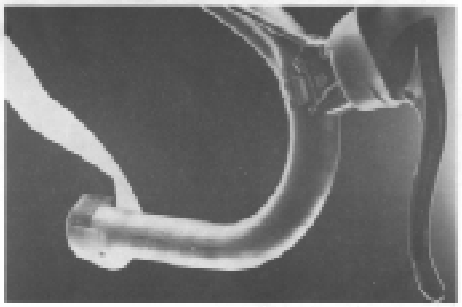
- 1 package of handlebar wrap
- plastic adhesive tape (cotton *are available*)
- transparent tape
- brake hoods (if necessary)
- scissors
- screwdrivers
- small rubber mallet



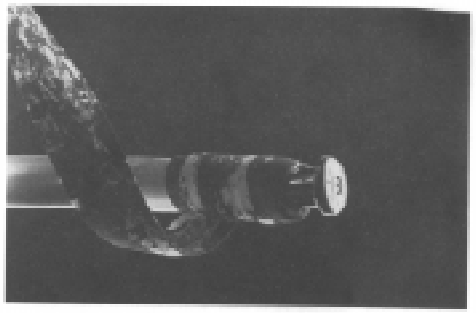
1. Roll the brake hoods away from the bar or cut them off. *Carefully pry internal handlebar end plugs free with a small screwdriver. If it loosen the center screws on internal-expanding types.* Remove the finishing tape and old wrap. *You needn't remove external end caps on bar-end shift levers.* If the wrap is not supplied in halves, unroll and cut it in 2 equal pieces. Remove 2 inch length from each. *Sometimes these short pieces are provided in the package.* Place new rubber hoods in hot water to soften them.



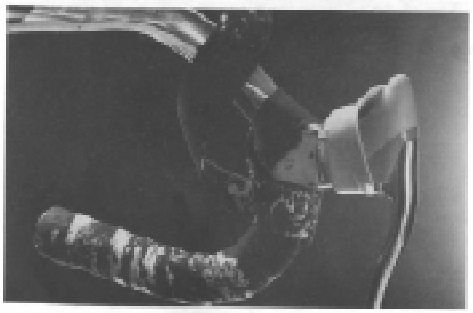
2. If you have aero levers or ramped shifters, check the cable routing. For aero levers, the housing should curve in a smooth, gradual bend in front of the upper portion of the bar. This way it's out of sight and fits easily in your grip when holding the bar tops. Bar-end shifter cables should travel underneath the bottom portion of the bar and pursue up the front side of the stems before exiting and curving to the down tube cable guide. Secure the cables with transparent tape if necessary.



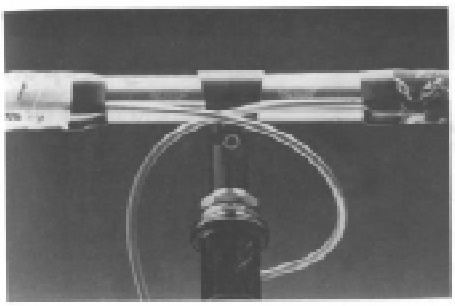
3. External end caps: If they were removed, install the caps and secure them with transparent tape. Affix another piece of tape to the end of non-adhesive wrap and tape it to the end cap. Wind either type of wrap around the bottom of the bar, stretching it tight as you go. Overlap each turn about ½ inch.



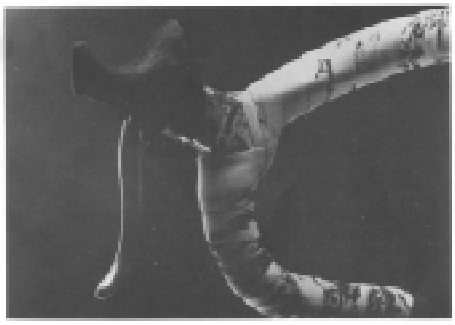
4. Internal end plugs: Tape the end of non-adhesive wrap to the bar end. Position other type of wrap so that most of its width is hanging over the edge. Wind it around the bottom of the bar, smoothing it right as you go. Overlap each turn 5mm. Tuck the overlap into position into the cap and end push the plug in with your palm or a small mallet. Tighten internal-expanding type with a screwdriver.



5. Attach the two (red) pieces of wrap so that they cover the brake lever mounting band. (Use masking tape if necessary.) Continue wrapping the bar, smoothing it right as you go. At the lever, wrap in a figure-8 pattern by going over the top of the lever, behind the bar, under the lever, behind the bar, over the lever, behind the bar, and under one final time. This will hide the clamp and surround the lever.



6. Continue wrapping until you reach the marker. Leave part of the bar top (about 1.1 inches from the stem). If you are using a bullhorn bars bar, end the taping sooner to accommodate it. Cut the wrap so its end is out of sight under the bar, and secure it with plastic tape or the finishing tape supplied with the wrap.



7. Uncoil the brake hoods. If you are installing new ones, note if there is a left and right one (usually marked "L" and "R"). While still wet, slide them over the lever tip and body. If you have equipped cables in inverted levers, you must detach the cables from the brake levers before installing new hoods.

Chapter Nine

Replacing A Spoke

By Jim Langley

Photography by Mel Lindstrom

Rear wheel spoke replacement is described here. For fronts, you needn't remove the wheel, and of course, there is no freewheel or cassette. Also, keep in mind that it's possible to do this on the road if you carry the tools and have a spoke or 2 taped to a chainstay.

Required Tools:

- repair stand
- proper size replacement spoke and nipple (measure from the bend to the tip, or take the wheel to a shop and ask a mechanic)
- grease
- 12-inch adjustable wrench
- small screwdriver
- utility knife
- spoke wrench
- tire lever

For freewheels:

- the correct brand of removal tool

For cassettes:

- 2 chain whips

For Shimano Hyperglide cassettes:

- one chain whip and the Shimano TL-HG15 locking tool

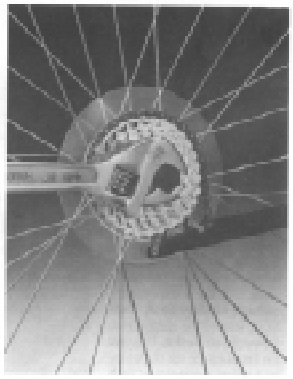
Equipment courtesy of Bicycle Center, Santa Cruz, California

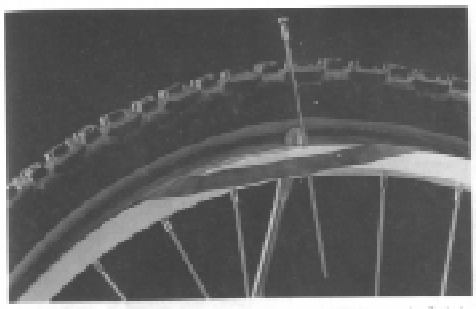
1. Place the bike in a repair stand. Shift to the smallest freewheel cog. Open the brake quick-release to allow the tire to clear the pads. (Flip open the small lever on sidepulls; disengage the straddle wire on cantilevers or U-brakes.) Open the axle quick-release. Remove the wheel by pushing it forward with one hand while pulling the derailleur back with the other.

2. Freewheels: Unscrew the quick-release skewer and install the freewheel remover. For notched (not splined) freewheels, clamp the tool in place with the skewer. (Leave off the cone-shaped springs.) Grasp the tool with the adjustable wrench and turn counterclockwise by pressing down when the wheel is on the ground. If you have a bench vise, place the remover in it and turn the wheel counterclockwise with both hands. Once loose, remove the quick-release skewer if you used it. Unscrew the freewheel the rest of the way by turning the remover with your fingers.

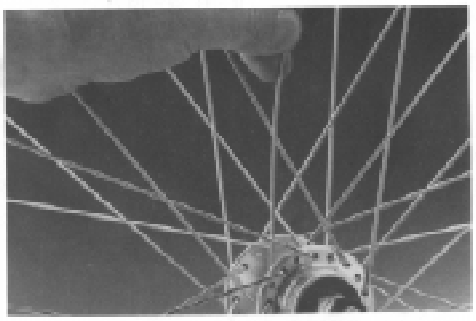
3. Cassettes: Remove the quick-release skewer. Place a chain whip clockwise on the large cog and hold it with one hand. Place another counterclockwise on the small cog. Push down hard on both to loosen. Unscrew the small cog completely and lift off the remaining ones. Place them carefully on the bench, so you can install them in the same order and orientation.

4. Hyperglide: Remove the quick-release skewer. Place a chain whip clockwise on the large cog and hold it with one hand. Insert the Hi-Vis tool into the locking. Turn the tool counterclockwise with the adjustable wrench. Unscrew the locking completely by hand and lift off the remaining cogs.



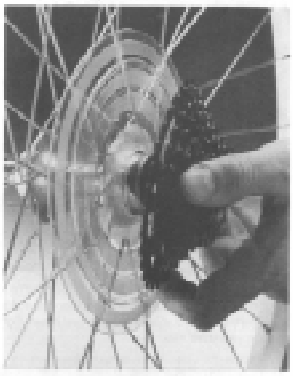


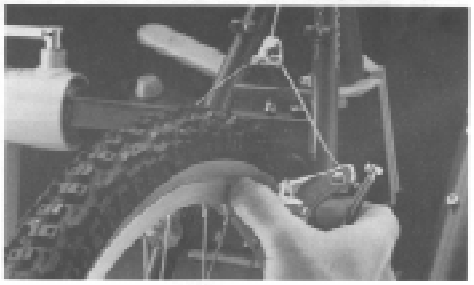
5. Unhook the tire and hold it out of the way with a lever attached to a spoke. Push the broken spoke and nipple past the rim strip, tire and tube, and remove it. If you can't get out, cut it between 2 spoke holes and pull it back slightly. Install the new nipple and work the hook end of the spoke out.



6. Install the new spoke. Make sure its head is correctly oriented in the hub flange. (They often look fine but will work out.) Weave it past the other spokes, duplicating the pattern of a spoke on that side with the same orientation. The most common lacing pattern is cross-two, which means crossing over 2 and under one spoke before reaching the new nipple. Lightly grease the threads and turn the nipple clockwise to engage it.

7. Install the freewheel or cassette. For a freewheel, grease the threads and screw it on by hand. It should go on easily. If not, remove it and try again to avoid stripping the hub. For cassettes, place the cogs and spacers on the body. Screw the smallest cog on by hand and snug it with the chain whip. For Hyperglide, install all the rings and spacers and thread on the retaining by hand. Snug it with the TL-HG15 tool and wrench.





8. Install the wheel. Turn the new nipple clockwise in half-turn increments. Use your thumb as a truing gauge by making it against a brake pad and spinning the wheel to check progress. Stop tightening when the rim remains equidistant from your thumb as the wheel spins around. If truing is difficult or requires excessive tension, the rim may be bent and need replacing. Have shop personnel check it.)

Chapter Ten

Overhauling Hubs

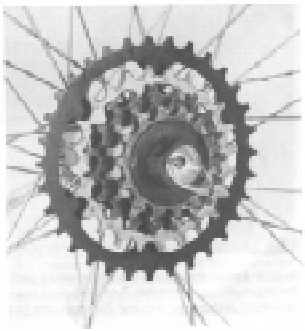
By Jim Langley

Photography by Mel Lindstrom

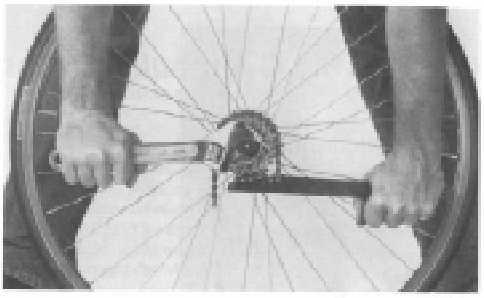
Tools and Supplies:

- freewheel remover or Shimano HG-15 Hyperglide retaining remover
- 15mm adjustable wrench
- vise (optional)
- chain whip
- cone wrenches
- small flathead screwdriver or pencil-shaped magnet
- large flathead screwdriver
- 18, 1/4-inch ball bearings for rear hubs
- 20, 1/4-inch ball bearings for most front hubs (Campagnolo Nuovo Record models require 18, 1/4-inch bearings)
- rags
- grease
- rubber mallet

The following advice is for loose-bearing types only. Rear hubs are described here since they're more complicated. Except for removing and installing freewheels and cassette cogs, front hub overhaul is identical.

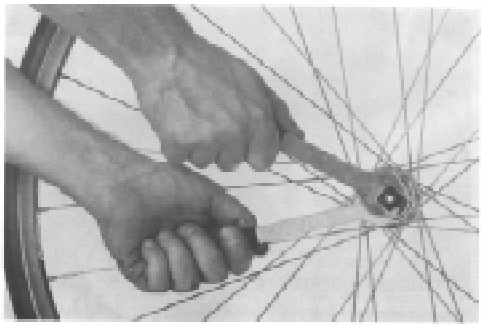


1. Remove the wheel. Unscrew and extract the quick-release. For conventional freewheels, install the prop or remover. Insert, assemble, and tighten the quick-release (without springs) to hold the remover in place. On most cassette hubs you needn't take off the cogs. However, for Hyperglide cassettes, install the HG-15 locking remover and place a chain whip on the largest cog in a position to turn it clockwise.

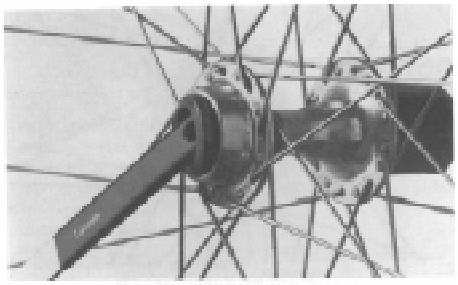


3. Hold the wheel upright on the floor. Position the adjustable wrench on the remover. Loosen freewheel by pushing down (counterclockwise) on the wrench. An alternative is to clamp the remover in a vise and turn the wheel counterclockwise. Once the freewheel breaks free, remove the quick-release and unscrew the freewheel the rest of the way.

For Hyperglide cassettes, press down on the chain whip with your left hand while pulling down on the wrench with your right (counterclockwise) to loosen and remove the locking. Carefully lift off the cogs.

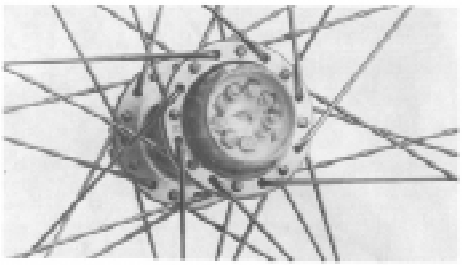


3. Clean the axle end, so you can see the various parts. Hold the left cone and lockout with the proper size cone wrenches. Turn the locknut counterclockwise. Unscrew it, remove the lockwasher, and unscrew the cone. Place each item on a rag in the proper order.

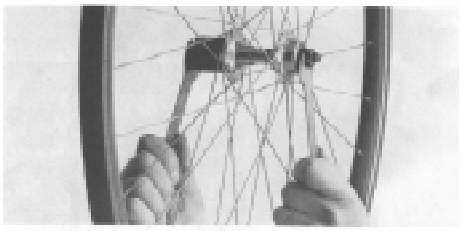


4. Pull the axle out of the hub from the right side. With a small screwdriver or magnet, extract the bearings from both sides of the hub. Using one end of a cone wrench or a large ring for screwdriver, carefully pry the dustcaps from both sides of the hub. If your dustcaps are attached to the cones, don't separate them.

5. Thoroughly clean the hub, (poke a rag through its center), axle, cone, locknut, and dustcaps. Also, clean but don't separate the parts still on the axle. Examine the cones and hub bearing cups for scoring or pitting. Replace worn cones. Where replacing the one that's still on the axle (right side), measure the amount of exposed axle; position the new cone the same distance from the end, and tighten it securely against the lockwasher and locknut. Damaged hubs in an inner gauge adjustment impossible and will wear parts rapidly. If this is the case, consider replacing the hub or buying a new wheel.



6. Coat both hub cups with a thin layer of grease. Place half the bearings (18 in front, 9 in back) in one side and cover them with more grease. Press the axle into the hub by hand, then coat it gently with the rubber mallet. Repeat the procedure on the other side. Use cone wrenches to ensure that the right axle parts are securely tightened against each other. Push the axle into the hub from the right side.



7. Thread the left cone onto the axle by hand until it touches the bearings. Install the lockwasher and locknut. Use cone wrenches to tighten the cone and locknut against each other. A perfect adjustment will have a tiny amount of play that disappears when the axle/wheel is clamped in the frame. Grasp the end of the axle and move it up and down to check this. Turn the axle to feel for smooth bearings.

If it's tight, place a wrench on each cone at the right cone's flattish. Hold the locknut and turn the wrenches counterclockwise slightly. If it's loose, hold the right locknut with a wrench and loosen the left cone and then the left locknut. To turn clockwise (photo). Recheck the adjustment. When it's correct, use 2 cone wrenches on the left side to lock it in place. Grease the freewheel threads, screw it on clockwise, and tighten with a chain whip. (Note Hyperglide cassettes cogs onto the body and tighten the lockring with the HG-1.5 tool and adjustable wrench.

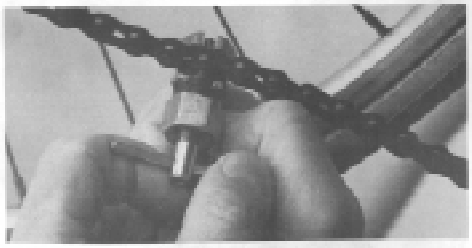
Chapter Eleven

Drivetrain Maintenance

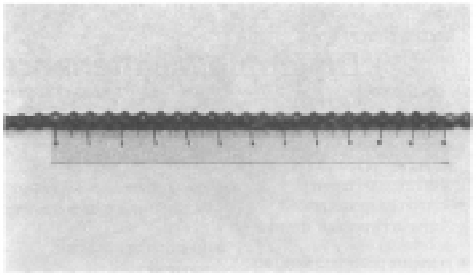
by Jim Langley Photography by Mel Lindstrom

Required Tools and Supplies:

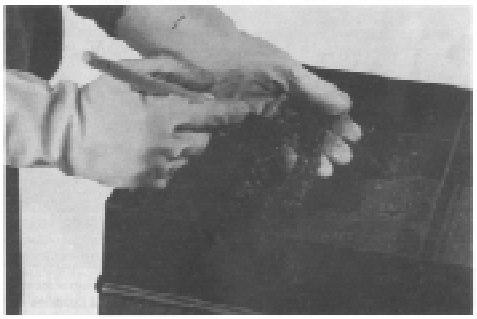
- chain rivet extractor (Shimano model TL-CN21 for Hyperglide and Uniglide chains)
- *Reinforced special pin* for Shimano Hyperglide chains (if applicable)
- crankarm puller and fixing bolt wrench
- 3-, 4-, 5mm allen wrenches
- 8/9-mm combination wrench
- pedal wrench
- pliers
- ruler
- solvent
- brush
- thin-blade screwdriver or Park IM-GSC.1 gear system cleaning tool
- 10 inch metal or plastic container
- spray or drip chain lubricant
- repair stand
- rags
- goggles
- rubber gloves



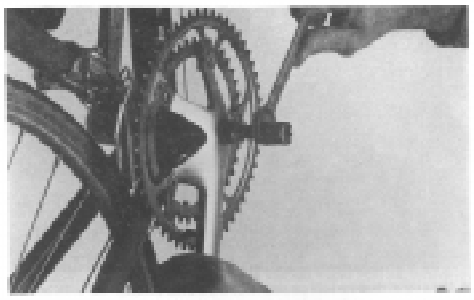
1. Place the bike in the repair stand. While pedaling by hand, shift the chain to the smallest freewheel cog and chainring. Place the chain rivet extractor on a loaded link. (For Shimano Uniglide or Hyperglide chains, use the TL-CN21 tool. Do not remove Hyperglide narrow chain rivets.) Carefully begin to push the rivet out by turning the tool's handle clockwise. If the rivet resists, unscrew the tool, clean the pin's alignment on the rivet, and try again. Carefully tighten until the rivet is flush with the back of the tool. Do not push it out entirely unless you are working on a Hyperglide chain (which requires a "reinforced special pin" for replacement). Unscrew and remove the tool.



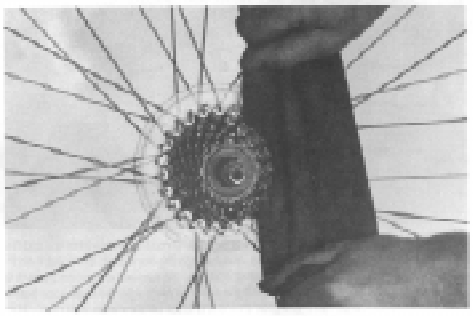
2. Flex the chain laterally to separate it. Remove it by pulling on the end with the protruding rivet. Lay the chain straight on its side on a workbench. Use a 12-inch rule to measure wear. Each end of the rule should be centered on a chain pin. If the distance from the first to the last pin is 12 inches or more, replace the chain. (Be sure it has the same number of links.) If you need a new chain, you may also need to replace some freewheel cogs as pins wear lopsided. (see Chapter Nine, steps 3 and 4, for cog removal procedure.)



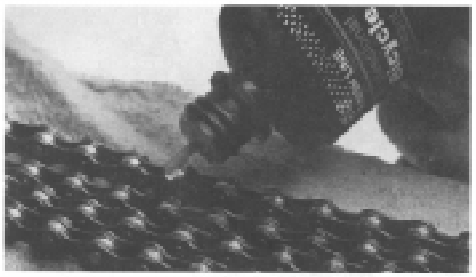
3. Place the chain in the solvent-filled container. Biodegradable water-based products such as Simple Green are safest but can promote rusting if the chain is not adequately lubricated immediately after cleaning. They also don't dissolve grime as quickly as petroleum-based degreasers. Then rubber gloves and goggles and brush the chain clean. Wipe it with a rag, then hang it to dry.



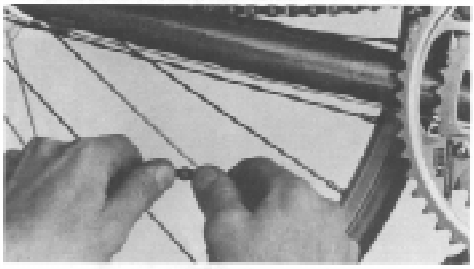
4. Remove the right pedal with the pedal wrench by turning it counterclockwise. Unscrew the dustcap and fixing bolt and remove the right crankarm with the correct puller. Place the crankarm in the solvent and clean it clean. Tighten the chainring bolts with a 5mm allen wrench. Reinstall the crankarm and tighten. Grease the pedal and dustcap threads and install.



5. Open the rear brake and wheel quick-releases and remove the wheel. Rest it on a bench with the freewheel cogs facing up. With a rag (rag and cloth between adjacent cogs to clean them. Dislodge dirt, mud, and gunk with a thin blade screwdriver or the round, toothed end of the PARK CC-1 cleaning tool. Reinstall the wheel and close the brake quick-release.



6. Use a rag to clean the front derailleur cage and the inner pulley. Check pulley bolt tightness with a wrench. Wipe the chain again with a clean rag and relubricate with dab of spray lube. Let it sit for a while. Apply oil to the center of the derailleur pulleys. Wipe excess lube off the chain.



7. Hold the chain with the protruding rivet facing you. Thread the chain rivetless end left through the pulleys, over the smallest cog, and through the front cage. Don't put it on the chainring. Pull the ends of the chain together and snap the rivetless end under the rivet to lay flexing the chain laterally. Carefully push rivet into place with the chain tool. Install a new reinforced special pin on Hyperglide chains and break off the excess with pliers. When done, the rivet should protrude equally on each side. To prevent a stiff link, place your thumbs on the newly fastened link and bend the chain laterally. Lift the chain onto the chainring. Turn the crank backward to make sure the chain flows smoothly through the rear derailleur. Loosen any stiff links.

Chapter Twelve

15-Minute Clean and Lube

By Fred Zahradnik Photography by Donna Chiarelli

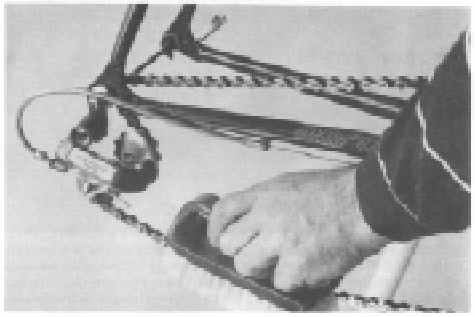
If you think it's a bother keeping your bike clean, imagine being responsible for improving, washing, and lubing a dozen or more each evening. This was one of Gary Santa's responsibilities as a mechanic for Coors Light Team USA, and other squads. "When you can't have dinner until you're finished, you learn some techniques for doing the job quickly but thoroughly," says Santa, now a bike shop service manager. He developed the system described here by observing the world's best race mechanics. Since running water is seldom available at race sites, no hose is required. Once you know the procedure, you should be able to pro-team clean and lube your bike in 15 minutes or less. (It takes Santa 10.) This method works well for mountain bikes, too.

Tools and Supplies:

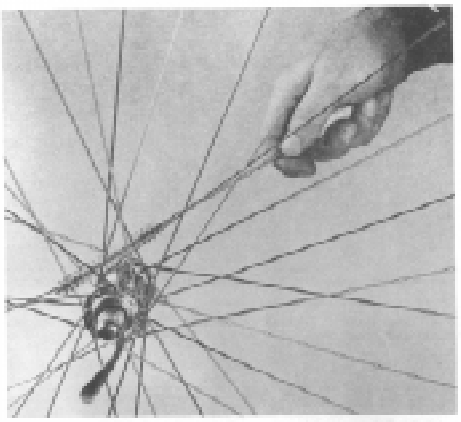
- three 5-gallon buckets
- warm water
- Dawn dish detergent
- citrus-based degreaser
- long-handle brush with long, stiff bristles
- small plastic-handle scrub brush
- small-diameter bottle brush
- small-diameter bottle brush bent into hull curve
- large sponge
- medium sponge
- several clean cotton rags
- bottle of lubricant with applicator tube
- spray furniture polish
- liquid or paste wax (optional)
- long screwdriver or rod
- quick-release skewer
- workstand

1. Prepare the buckets by putting plain water in one, and warm water mixed with a generous squirt of Dawn detergent in the other. One will be used for washing the frame and wheels, the other for the drivetrain. Use a different color or some other means of system. bering which bucket is for the greasy parts. Clamp the bike into a workstand. Spin the front wheel while watching the gap between the rim and brake pad to check for wobbles and hops. Remove the wheel and set it aside. Move to the rear wheel and do the same.

Spray a citrus-based degreaser (a good choice because it's safer than petro-based solvents for you and the environment) onto the freewheel cogs, then set the wheel aside with the freewheel slanted down so your work guunk from dripping onto the rim and tire.



2. Place a long screwdriver through the cutouts in the rear derailleur to support the chain. If your chainstays are solid, use an old quick-release skewer (not your current one because it can be damaged). Position it in the deepest slot, then snug it just enough to hold. Now when you turn the crank, the chain should run mostly over the skewer or screwdriver. Spray the chain and rear derailleur pulleys with degreaser, then let them soak while you go to the next step.



3. With the front wheel standing on top of the frame with bucket, dip the long-bristle brush into the suds and scrub the rim and tire. Next, dip the straight bottle brush and use it to clean the hard-to-reach places. Then rinse the wheel with the large sponge and water, and set it aside to dry. Use the same procedure for the rear wheel, after scrubbing the freewheel with the curved bottle brush and walk from the drivetrain bucket.

With the bike in the workstand (refer to photo 2), clean the chain. Dip the small nylon brush into the drivetrain bucket, then hold it against the top, bottom, and sides of the chain while you turn the crank. Use the brush on the lower run of chain just ahead of the derailleur pulleys, and turn the crank in the same direction as you do while riding. This keeps the chain from jumping off the chainring. The pedestrian also works best when the chain is on the biggest ring. Dip and repeat until the chain is clean. Hold the brush against the rear derailleur pulleys to clean them, too. Rinse by dipping the medium sponge into the pail water, then squeezing it above the chain while the crank is turned.

4. Wash the rest of the bike with the large sponge and frame bucket. Use the straight bottle brush to get at difficult spots, such as the bottom bracket and behind the front derailleur. Avoid getting water on the saddle and handlebar tape if they're absorbent.

5. Rinse the frame with the large sponge and clean water. Check for cracks or dents in the frame and fork. As you let everything dry, return to the wheels and inspect the tires for cuts and abrasions. If you have tubulars, make sure they are still firmly glued to the rims. Wipe away any water remaining on the bike with a clean cotton rag.

Drip a little lubricant into the back of the freewheel and spin it several times. Put the wheels in the frame and touch true them, if necessary, using the brake pads as your guide. Drip lube onto each link of the chain. Apply a small drop of lube to the rear derailleur pulley bushings, front and rear derailleur pivots, brake pivots, and where cables pass in and out of stops and brackets. Wipe off any excess. Finally, spray the frame with a furniture wax such as Pledge, or, if you can spare more time, use a liquid or paste wax. Buff with a clean cotton rag, then stand back and admire your work.