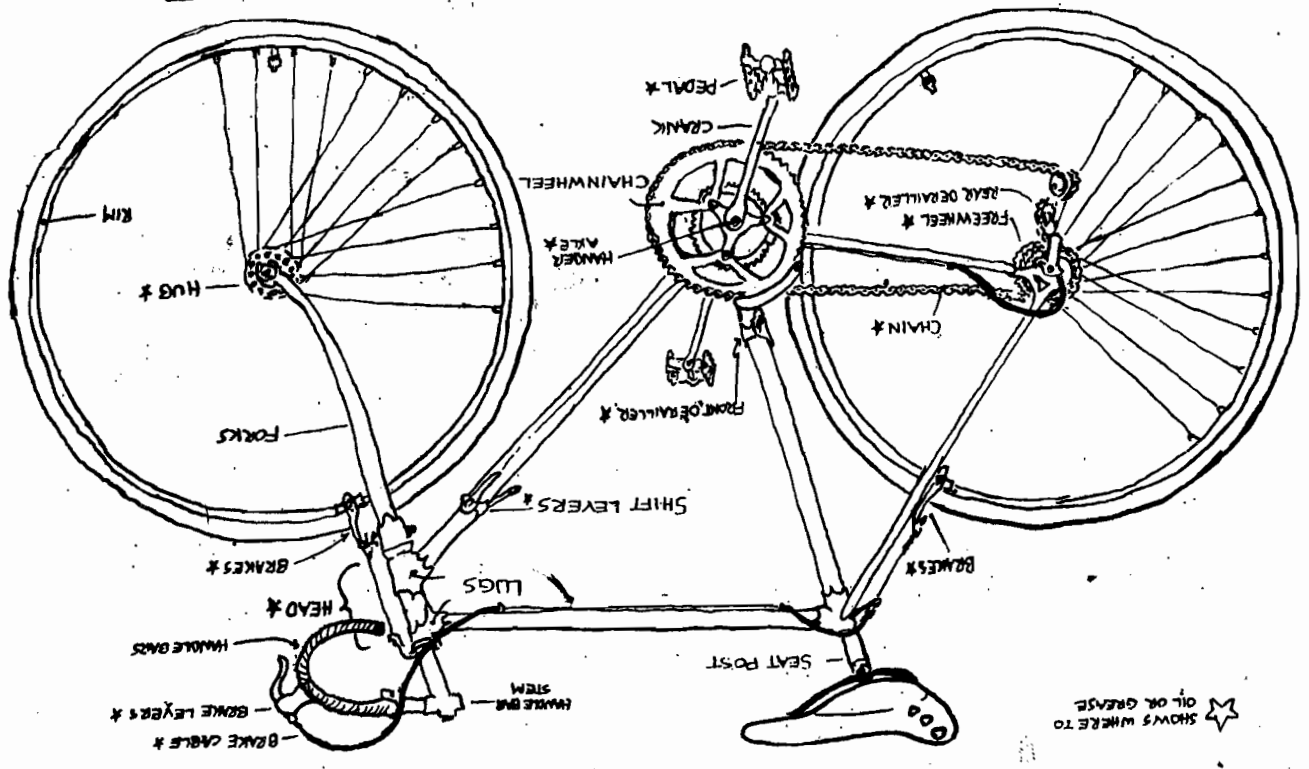


For more - contact Neal @ PO Box 1974 Asheville, N.C. 28601 !!!

DIAGRAM OF A TEN-SPEED BICYCLE



How to fix your bicycle

by Helen Garry
drawings - T White



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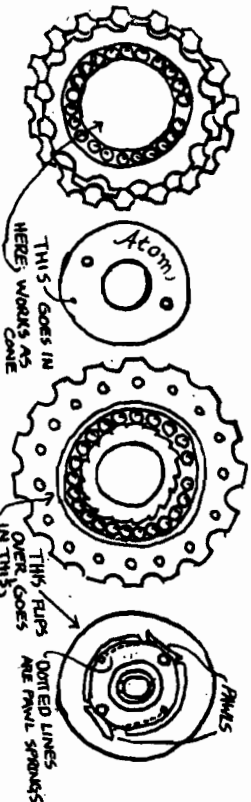
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come out. When it starts coming out clear, you're done. Let it dry well (spin to help it and leave overnight), then oil. Be careful not to get kerosene on tires.

INSIDE OF FREEWHEEL



The freewheel can be taken further apart. Individual sprockets can be replaced. You'll probably need more tools for this but perhaps you can improvise. The two big sprockets usually unscrew clockwise as you face them from the back of the freewheel and the three small sprockets unscrew clockwise as you face them from the front. You can also take the body of the freewheel apart but be careful not to loose the tiny balls and ratchet springs inside.

FRAMES

Frames come in different sizes—usually 19-25" for an adult 10-speed. That is the distance from the hanger axle to the top of the frame near the seat post.

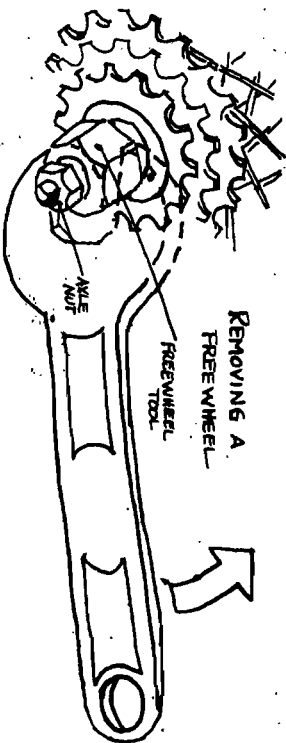
Frames get bent, usually the forks and sometimes around the head. The forks can be straightened. There is a fancy tool for this but a big piece of pipe slipped over the fork can do fine. Just put the pipe on the fork (fork can be on bike) to where it is bent and use your strength. Be gentle, you don't want to bend it too far. If you care about paint, wrap rags around the forks first. Remember metal fatigue, see p. 6.

You can buy new forks. Some come in different lengths (know your frame size), some come long and need to be cut to size with a hacksaw. If you do this, screw adjusting cone or locknut on the forks before you saw. When you take it off after it will straighten out any threads messed up in sawing. To install forks, see p. 25.

Other bent parts can be straightened (even really bent ones). Don't give up until you try. Use brute force or try damping the bike to something solid (like a 2x4). Remember metal fatigue.

FREE WHEEL

Freewheels need to be removed to replace spokes on that side of the hub, to be replaced when worn (littlesst gear wears fast), or taken apart. If you are taking a wheel completely apart, remove the freewheel before cutting or removing spokes.



TO REMOVE: remove wheel, remove axle nut and washer on freewheel side, put on freewheel remover (get one that fits your freewheel), and replace axle nut after freewheel remover to hold it in place. You may also have to remove the thick nut-like spacer. Unscrew counter-clockwise: Freewheels are usually hard to get off. Try Liquid Wrench. Use a wrench with a long handle on the freewheel remover to get a lot of leverage or hold remover in a vise and turn wheel. Be careful not to damage the freewheel if the remover slips (removers also tend to slip easily). Be extra careful with a two-prong remover because often when the freewheel seems to be moving, it is only the remover moving and stripping something. The splined kind of freewheel is much easier to get a good hold on. Once the freewheel is loosened, remove the axle nut and keep screwing the freewheel.

Now is a good time to put on a **SPOKEGUARD** (to stop the derailleur from ever going into the spokes and messing up both the spokes and the derailleur). Just put it in place before replacing the freewheel.

TO REPLACE FREEWHEEL: Just put it on hand tight. It will tighten itself as you pedal (which is why it gets on so tight). But first put a little beeswax, Neyer-Seez, or grease on the threads so that next time the freewheel will be easier to remove.

TO CLEAN: Freewheel can be on wheel. Squirt kerosene so it gets inside. Spin freewheel and watch the dirty kerosene

This book is to help you fix your bike. Bikes are basically simple machines and you should be able to fix most anything that goes wrong with your bike. I'll try to explain how things work as well as what nut to turn.

There are two main things to remember:
1) Don't be afraid of your bike. You should be able to take most of it apart and get it back together like it was, especially if you are neat and careful and watch what you are doing. Don't be careless—but don't be afraid.

2) Use common sense. If something goes wrong, look carefully. Figure out how the thing is supposed to work. Where could something go wrong? Can you see what is wrong? Try something and see if that works. If it doesn't, try something else. Just go easy and think about what you are doing. If you take something apart, make sure to notice what it looked like before.

HOW TO USE THIS BOOK. To save space I've tried to repeat things as little as possible. Because of this and because many mechanical principles apply to more than one part of the bike, you should try to read thru the book quickly at first, then use specific sections as you need them. I'll call things by names that are unfamiliar—refer to the diagram on p. 48 or one nearby.

The division of the book into two main sections is somewhat arbitrary. I tried to put common ailments (mainly adjustments) in the first section and more major things in the second. Both parts supplement each other and you should check both sections.

HOW TO CARE FOR YOUR BIKE.

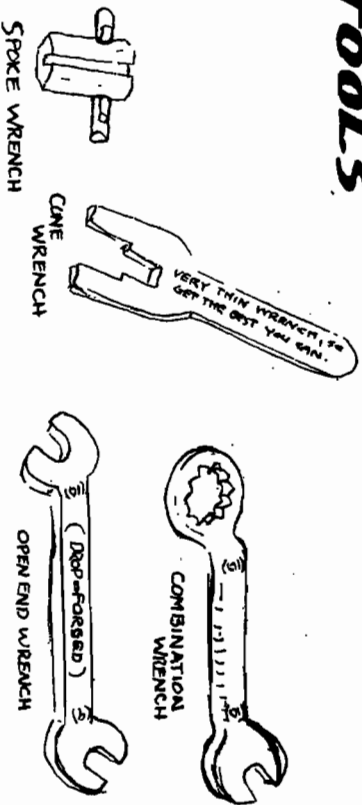
Keep your bike clean, lubricated, and adjusted. Bikes have a lot of moving parts. Grit, lack of lubrication, and poor adjustment can ruin parts fast. On the other hand, if kept in good shape, they should last long. Be aware of your bike and unusual sounds or feelings. You can often catch (and fix) problems before they get serious. Don't let any part continually scrunch or rub. It will get worn out.

ON BUYING PARTS.

Many stores don't sell small parts but some do—try to find them. Take the old part with you to get the right replacement. There are mail order places if you have trouble getting parts. The main ones are:


Wheel Goods, 2737 Hennepin Ave., Minneapolis, Minn. 55408
 Big Wheel, 310 Holly St., Denver, Colorado 80220
 Cyclo-Pedia, 311 N. Mitchell, Cadillac, Mich. 49601

TOOLS



The main tools you will need are wrenches and a

screwdriver. Wrenches can be a set of wrenches or an adjustable crescent wrench (6" is good). European and Japanese bikes (and American 10-speeds) take METRIC wrenches. If you're into buying, you can get a cheap set of metric wrenches (try to get 8-17 mm open end or combination wrenches) for about \$3-4.

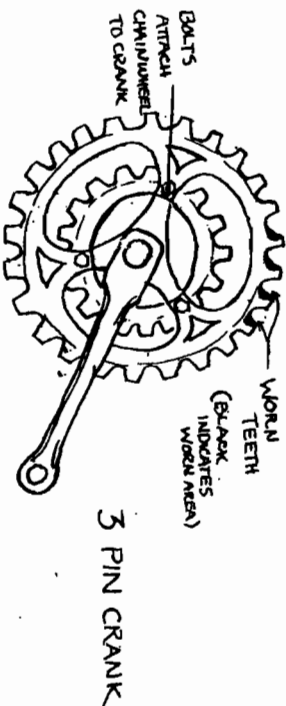
Screwdriver—big and little if you have them. Check your bike, you may need a Phillips screwdriver too (the head looks like ).

A spoke wrench (about 40¢) to adjust spokes, a cone spanner, to adjust hubs (35¢), and tire levers to remove tires (75¢ for set of 3) are probably worth having.

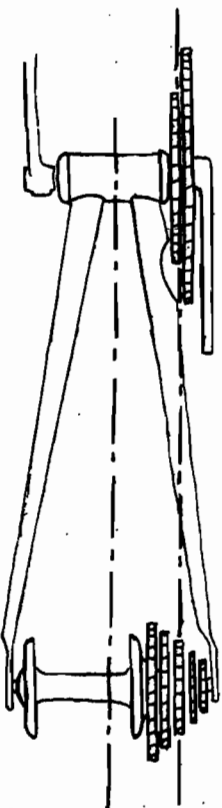
LUBRICATION. It is a good idea to remove and clean the chain regularly. To clean chains well: remove, soak in kerosene, dry, soak in oil (like a can of motor oil), hang and let drip. WD 40 can be used instead of oil. You can also drip oil on the chain as you turn pedals with chain on bike. Wipe off excess, extra oil collects grit.

CHAIN WHEEL

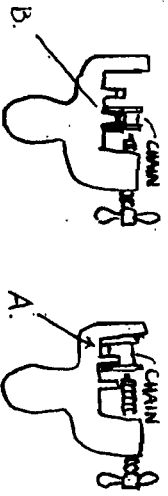
On 10-speeds the chainwheel can usually be removed from the crank by undoing 3-5 little bolts. Many double chainwheels can be taken further apart (more little bolts) so you can replace only one of the chainwheels if you want. Chainwheels sometimes get bent and need to be taken off and straightened or replaced. A crooked tooth can usually be straightened on the bike (try vise grips or a crescent wrench).



ALIGNMENT. The chainwheel and freewheel must be lined up correctly. Looking from above, the middle sprocket on the freewheel should be lined up between the two chainwheel sprockets. You can correct alignment by placing washers or shims (thin washers) on the appropriate side of the freewheel or getting a different length axle to change the chainwheel's position. You might also be able to move the right crank (and chainwheel) over some on the axle you have.



TO REMOVE LINK: Put chain in tool in position (A). Turn handle (making sure pin hits squarely on the rivet) until the rivet is pushed almost out. Don't push it completely out, leave it in the last part of the link. Otherwise you need 3 hands and much patience to get it back in.



TO RECONNECT: Place chain in position (A) and push rivet back in. If rivet came all the way out before, try holding it in place with needle-nose (thin) pliers while a friend turns the chain tool handle. Then check for tight link.

Chain length depends on your gear ratio. The chain has to be long enough for the derailleur to work with the chain on both large sprockets. If the chain is too long or if the derailleur can't take up enough slack, the chain will slip, especially when on the small sprockets and under strain.

WORN CHAIN. Chains wear out and stretch. Look where the chain goes around the chainwheel. Pull. Does it fit snug or is it loose? Hold the chain between the chainwheel and freewheel and wiggle it sideways. Lots of sideplay (more than 1/8") is a sign of wear. A worn chain can cause the chain to skip. If your chain is worn, check both chainwheel and freewheel sprockets for wear too. Any one alone may be worn, but often all need to be replaced.



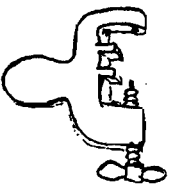
TIGHT LINK. A tight link can cause the chain to come off. Feel for tight links. On 10-speeds you can usually see them as the chain goes around the little derailleur wheels. To loosen a tight link, bend chain from side to side. Or put chain in tool in position (B) and turn handle a little. O.K.? If not, turn the chain over and push from the other direction.

For 10-speeds you might need a chain tool to take the chain off (about \$2.50) and a freewheel remover (\$1-6, depending on what kind fits your freewheel).

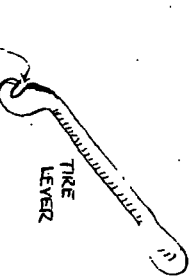
Your tool kit for home or trips should also include some spare parts such as brake rubbers, brake and gear cables, and a spare tube. And a tire patch kit.

On tools: expensive ones are usually stronger and more durable than cheap ones. If you can and if you'll use them a lot, buy a good set of wrenches and a cone spanner. Drop forged tools are stronger than cast ones. They will say "drop forged" on them if they are.

Vise grips are handy for various things, but use them carefully, they are powerful and can scrunch things.

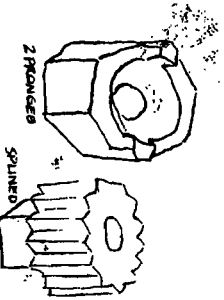


CHAIN TOOL



TIRE LEVER

SOFT HEADS AND SPOKE TO HOLD IN PLACE



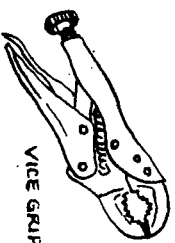
FREE WHEEL REMOVERS

2 PROCKETS

SPLINED



CRESCENT WRENCH



VICE GRIPS

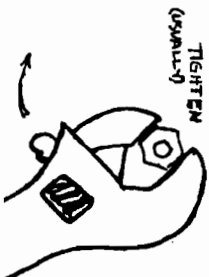
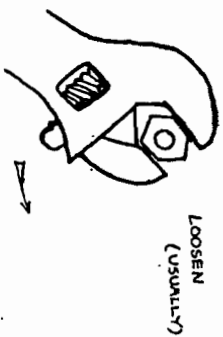
GENERAL TIPS

Here are some general things to know.

Big, huge nuts can be tightened with lots of strength but little ones can't—the threads will strip or the bolt will break.

Use the right size wrench. The wrong size (or a crescent wrench too loose) can strip the edges of the bolt, making it hard to get a wrench on next time. Wrong size screwdrivers can mess up screw heads too.

Turn wrenches the correct way (to lessen chance of stripping nuts or breaking wrenches). Turn so pressure is on most solid arm.



Bolts (and screws and nuts) almost always tighten clockwise and loosen counter-clockwise. This is "right-hand thread". Bolts in some places have "left-hand thread" and tighten counter-clockwise. The left pedal on bikes and sometimes the left hanger cup and locking have left-hand thread. The reason for this is so that pedal and hanger stuff will get tighter and not loosen as you pedal.

Threads differ. Different countries use different threads (different thickness and number of threads per inch) on bolts and such. When you replace a nut, make sure it has the same thread as the bolt. If it doesn't go on easily—don't force it. That's a good sign the threads are different and you'll strip them. The main kinds of threads are American, French, and English. Size standards differ too so beware if you are changing parts. Watch for different diameters and/or threads of handlebars, handlebar stems, forks, hangers, headsets, and pedals.

Locknuts (or lockrings) tighten down on nuts or cones to make the nut or cone stay in place. Usually the nut or cone adjusts something and its exact position is important. To tighten a locknut: hold the nut with one wrench in the position you want it, then tighten the locknut down on it with another wrench. Lockwashers also help keep cones in place. They usually have a "key" that lets them slide up and down but not turn.

Liquid Wrench or other "penetrating oil" loosens tight joints. Nut stuck on tight? Squirt some on, give it time to soak in, tap gently to help it get inside, then try.

Metal fatigue. Something happens to metal when it's bent or pounded on the wrong way (the molecules get messed up or something) and it gets weakened. So if you have to do those things to your bike, be aware that you've possibly got weaker metal under you.

GEAR RATIOS. The ratio of the gears (how often the wheel turns compared to how often the pedals turn) on a 10-speed depends on the number of teeth on both the freewheel and the chainwheel sprockets. The formula for finding the ratio for any gear is multiply the diameter (in inches) of the rear wheel (i.e. 27) by the number of teeth on the chainwheel and divide by the number of teeth on the freewheel sprocket.

For example, with 36 and 50 teeth on the chainwheel and 14, 17, 20, 24, 28 teeth on the freewheel (27" wheel), the gear ratios are:

gear	front	rear	ratio	gear	front	rear	ratio
1	36	28	34.7	6	50	28	48.2
2	36	24	40.5	7	50	24	56.3
3	36	20	48.6	8	50	20	67.5
4	36	17	57.2	9	50	17	79.4
5	36	14	69.4	10	50	14	96.4

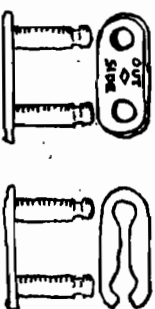
This means that in the first gear you go 34.8 x π " for every revolution of the pedals. Notice the overlap.

You may want to get a different chainwheel or freewheel to get a better gear ratio. Some derailers can't handle wide ratios (can't take up enough slack in the chain). Keep that in mind if you're changing things. If you change the gear ratio, you may also need to change the length of the chain.

CHAIN



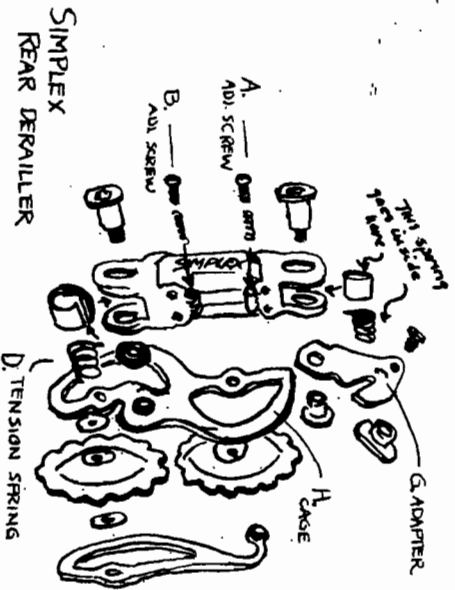
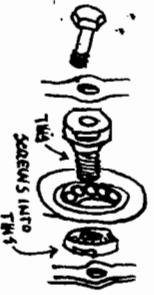
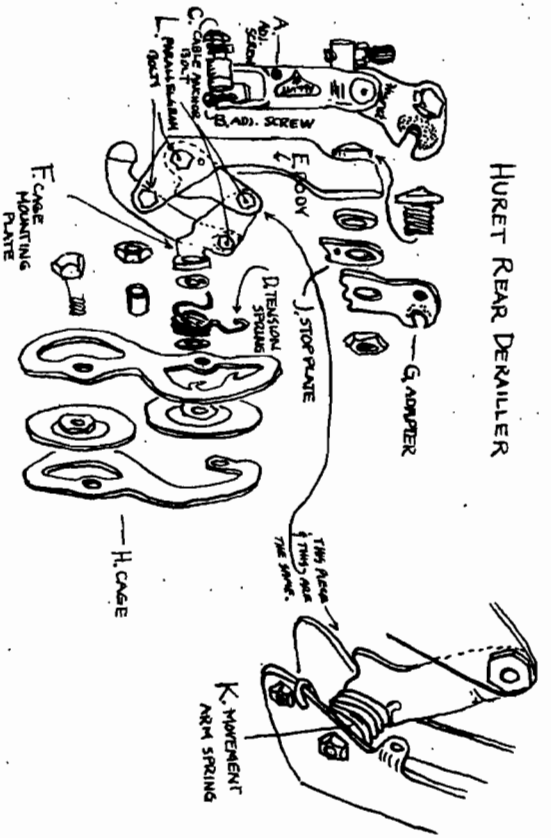
CHAIN TOOL PUSHES RIVET OUT.



MASTER LINKS

Chains on 1 and 3-speed bikes usually have a "master link" to make it easy to take the chain off. It'll look different from the others. Find it. Some snap off (pry with a screwdriver) and some slide sideways. Chains on a 10-speed are too thin to have room for a master link (they are thinner than 3-speed chains) so you just have to take out one of the rivets. A chain tool makes this easy but a hammer and punch will do.

HURET REAR DERAILLER



SIMPLEX
REAR DERAILLER

GENERAL CARE & MINOR THINGS

LUBRICATION

Bikes have moving parts—where metal rubs against metal. Most of those places (head, hanger, hubs, pedals, gears) have bearings to reduce friction. You want those joints to be smooth.

Oil and grease lubricate joints. Oil often, maybe once a month or after you've been in the rain or after a long ride. Use light bike, household, or sewing machine oil. If there is a hole with a cap or clip over it to pour oil into (oil fitting), use that. Put grease or oil inside cable casings to let cables slide easier. Bearings packed with grease should be repacked every 6-12 months. If you don't do that and they are dry, oil is better than nothing, but plan to grease them soon. Grit and dirt crunch around, wear out parts, make them sticky, uneven, etc.. The bike is built to make it hard for grit to get inside, but it will, especially if nearby areas are dirty or if things are loose. So keep it clean and adjusted. If your seat post is open on top, cover it with tape to keep dirt out. **DO NOT** get oil (or grease, kerosene, Liquid Wrench, etc) on rubber. They all eat rubber.

LUBRICATION CHECK LIST:

Grease (once a year)—head, hanger, hubs, pedals.
Oil (once a month)—derailleurs, 3-speed hub, freewheel, chain, cables, hand brakes.

AIR

Keep tires pumped up. Tires usually say on them how much air they hold but here's an idea:

27x1 1/4 — 60-80 lbs. 26x1.75 — 30-50 lbs.
 26x1 3/8 — 40-60 lbs. 20x1.75 — 30-50 lbs.
 Cheap or old tires will usually not hold as much air pressure as new or expensive ones. Heavier people should have more air in their tires than little skinny people.

Too much air can cause the tube to burst out from under the tire—and a blowout (which means a new tube and maybe a new tire if the blowout stretched the wire around the edge of the tire). Too little air causes more friction between the bike and the road which means harder riding and steering. It will also cause the tire to wear faster and maybe crack open on the sides. The wheel rim will also be less protected and more liable to be bent by bumps.

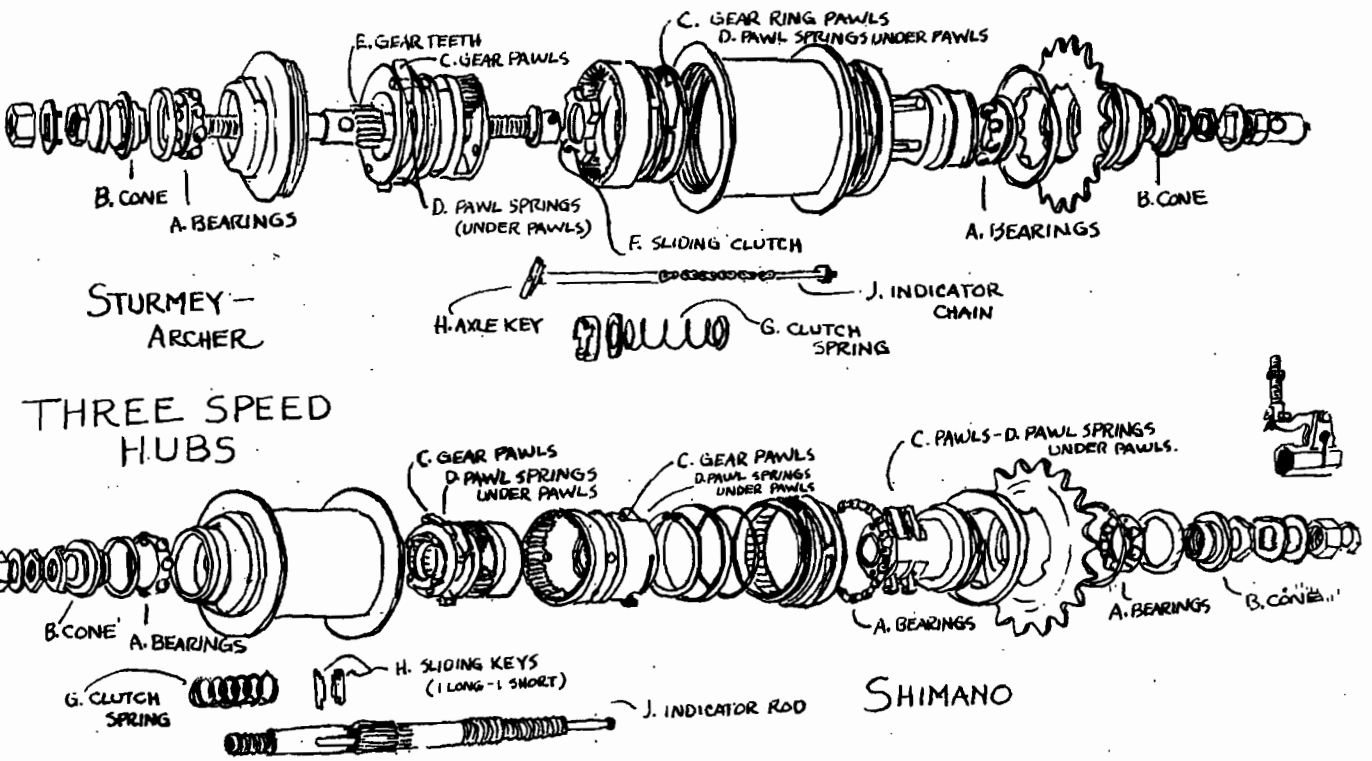
Beware of gas station air pumps—they fill tires very fast, attendants often aren't used to bicycles, and gauges often don't work right. Air pressure goes down with time so check your tires regularly.

WHEELS

Wheels should be firmly attached to the frame and centered. If you can wiggle the wheel sideways with your hand, see if the axle nuts that hold the wheel to the frame are tight. If they are, you probably need to adjust the cones in the hub (see p. 31). If the wheel wobbles only when it's turning, you need to true the wheel (p. 36) or straighten the rim (p. 32). Wheels often need to be removed to do other things. That is usually easier to do with the bike upside-down.

TO REMOVE front wheel: Loosen axle nuts. If you have quick-release levers, flip the lever so it is perpendicular to the wheel. If you have hand brakes and they seem to hold the wheel in—just pull and wiggle the wheel past them. If you have a quick-release unit on the brakes, loosen that to pull the wheel out easier.

Rear wheels usually have an extra thing to do. For coaster brake wheels, undo the brake arm (A) from the frame. For



COASTER BRAKES are more complicated but can and should be cleaned. They all differ so I won't give details. Take out the parts carefully and keep them in order. When you get the hub apart, check for worn bearings (A), cones (B), clutch (C), driver (D), discs (E), and shoes (F). Replace worn or broken parts, clean well, grease the inside of the hub, and reassemble.

GEARS - 3 SPEED

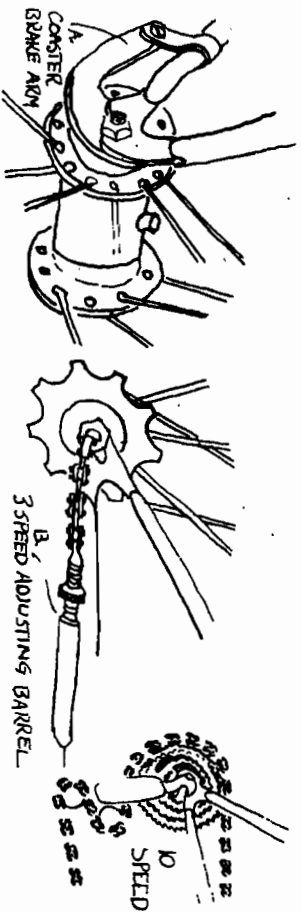
These have more little parts than coaster brakes. You can take them apart but go slow. Some simple things to check before you take the hub apart: indicator chains (J) sometimes aren't screwed in tight or are bent, cable may be frayed, gear levers sometimes need oil, or hub may need oil (it needs oil often).

When you get the hub apart check for worn bearings (A), cones (B), gear pawls (C), pawl springs (D), gear teeth (E), clutch (F), clutch spring (G), sliding key (H), or bent axle or dust caps. Replace worn parts and clean all parts well. Adjust cones carefully when you reassemble. Oil well (thru oil fitting (K)).

GEARS - 10 SPEED

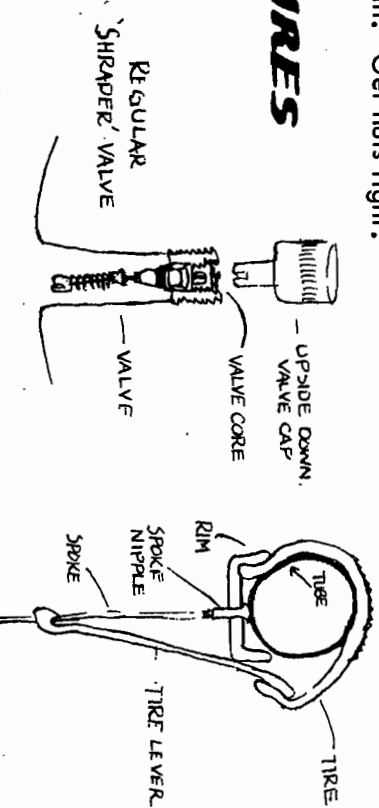
People often think that derailleurs are broken or useless when only one part is bent or broken or simply out of adjustment. Look carefully. What is wrong? Out of alignment? Rear cage should be parallel to freewheel. A part bent (check especially E, F, G, H)? Straighten it (take it apart if you need to). Little wheels don't turn easily? They have bearings inside and need to be cleaned and regreased regularly. Whole derailleur sticky? Try oil. Or loosen some of the joints (like the Huret parallelogram bolts (L)—loosen nut and turn bolt from other end to loosen joint). Or take the whole thing apart and clean it well. Parts worn (like J) or springs (K or D) weak? Replace them. Check adjusting screws (A and B) and cable tension.

3-speed wheels, undo the gear cable where it attaches to the wheel (B). For 10-speeds, don't undo anything, just pull the derailleur towards the rear of the bike (with chain on small rear sprocket) and pull the wheel out. Notice how the chain goes around so you can get it back in right.



TO REPLACE WHEEL. Do the opposite of what you just did. Washers, if you have them, usually go outside the frame, right before the axle nuts. Hold wheel centered in the frame as you tighten the axle nuts. For coaster brake, make sure the brake arm faces the right way so you can hook it up. For 1 and 3-speeds, pull wheel back so there is about 1/2" play in the chain. Get nuts tight.

TIRES



To patch a flat you don't have to remove the wheel (tho that is usually easier) or even the tire. Pry out one side of the tire all around and pull out the tube. Careful. Don't use a screwdriver to pry, you're likely to just get one more hole. There are special "tire levers" but blunt plier or spoon handles will do. Put one tire lever in and pry out tire. Put second lever in 3-4" away and pry out tire. Repeat with third lever if necessary. By then you should be able to push one lever the rest of the way around. Be very careful not to poke or pinch the

tube. Go easy on the tire too. There's a metal ring (the "bead") around the edge which can stretch or break and then the tire won't stay on well.

To find the hole, blow up the tire and listen and feel for the leak. If that fails to locate leak, hold tube under water and watch for bubbles.

Tire patch kits usually have instructions. For regular patches: clean area well, roughen the surface with some kind of buffer (sandpaper will do), put on the glue and let it dry, put on the patch and press down well. If you have the kind where you cut out the patch, cut it big enough to hold well and bevel the edges if you can. There are patches for tires too, called "boots" that you can often use regular patches.

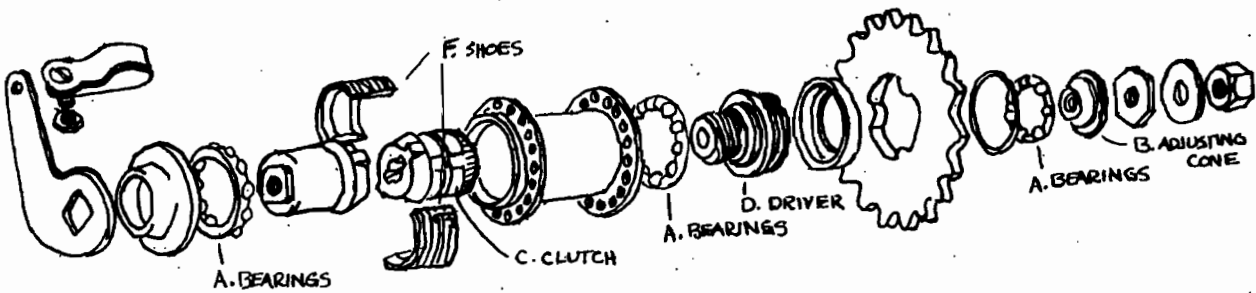
Check to make sure there is no glass (nail, etc.) left in the tire before you replace it. Again be careful putting the tire back on. The tire lever can easily pinch the tube and make a hole. If you can push the tire on without levers, do so.

If the valve leaks, you can tighten it by screwing the inside part (valve core) in more. Valve caps often have a little thing on the end for this. If yours doesn't—borrow or buy one. You can also buy new valve cores if yours breaks, but better still take out the one from the next tube you throw away (just unscrew it with the valve cap) and keep it for a spare.

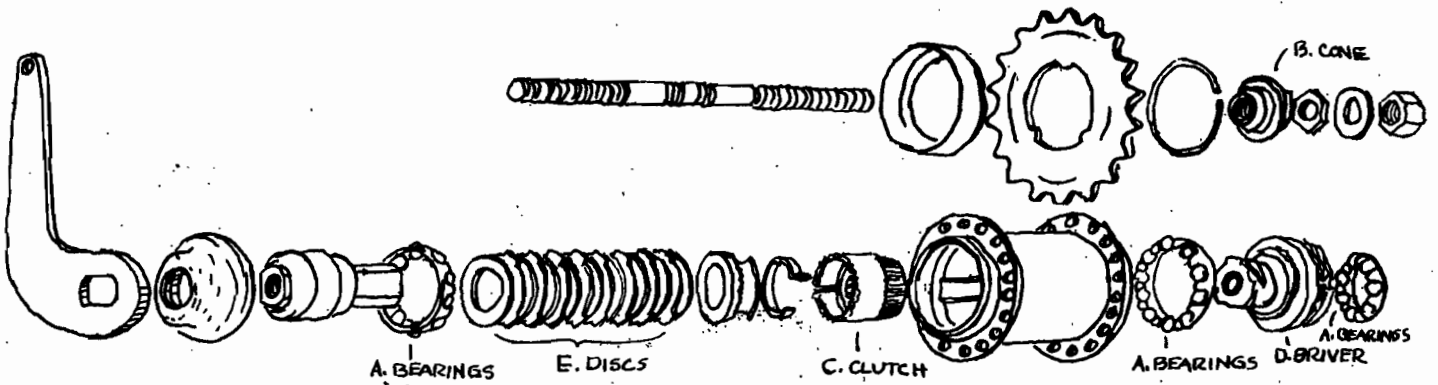
Tires sometimes tend to come out of the rim when the tubes are blown up to proper size (and, of course, when blown up too much). This can be due to the extra thickness of the tube near the valve, old and tired or cheap tires, a stretched wire on the tire edge due to a blowout or rough handling while changing a flat, or dented rims. When it happens, try letting out some of the air, pushing the tire back in where it came out, and holding it there while you pump the tire up slowly. Does it still come out? You may need a new tire or straighter rims but this method often works, at least as a stop-gap measure.

If it happens around the valve, push the valve up into the tire a little and make sure the tire fits well around the tube. Then pull the valve out again and pump up tire.

Wear on the side of the tire is probably due to the frame or brake rubber rubbing against the tire. If it's the frame, loosen axle nuts and straighten the wheel. If it's the brake rubbers, they should hit on the rim, not the tire (see p. 15). Cracks on the side of the tire are probably due to under-inflation.



BENDIX MODEL RB-2



SHIMANO

COASTER BRAKES

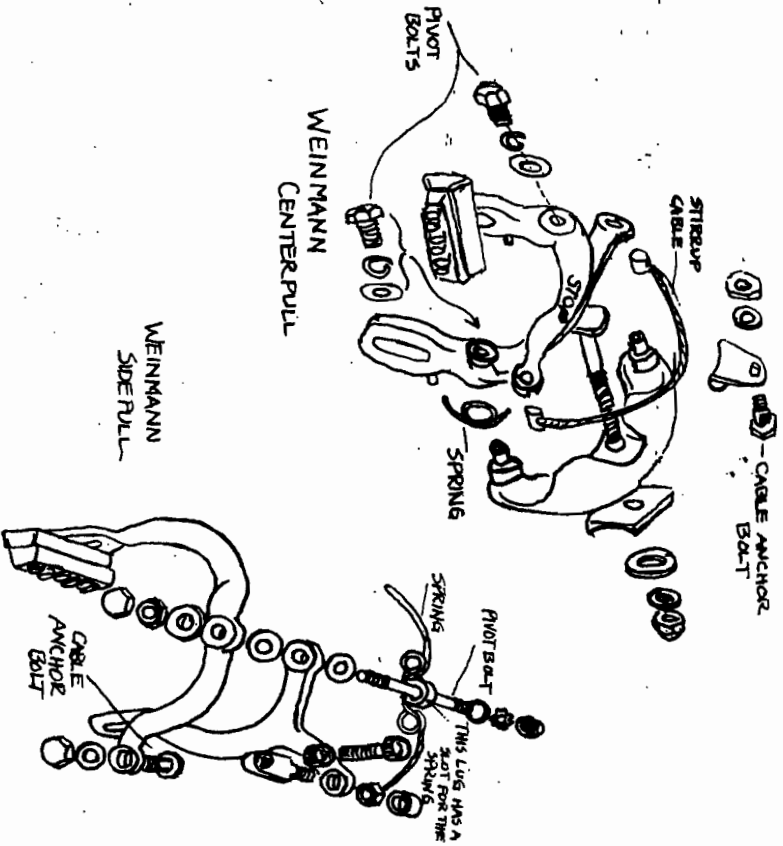
do, see if you made a mistake. If not, clip or file off the extra. The tension on all spokes should be fairly equal, check that. Then replace the rim strip, tube, and tire.

EGGS: The above should get out side-to-side wobble. Wheels also get egg-shaped which is harder to deal with. For the point of an egg, tighten spokes going to both sides of the hub from that part of the rim (turning spokes farther from the main spot less). For a flat spot, loosen spokes to both sides of the hub.

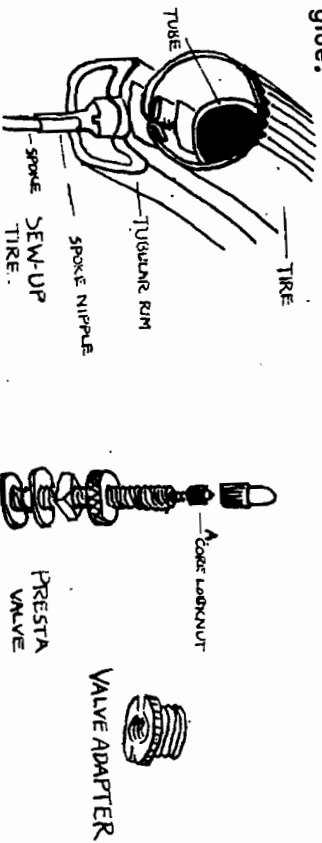
If you can't get out the wobble or egg by trueing, you need a new rim.

BRAKES

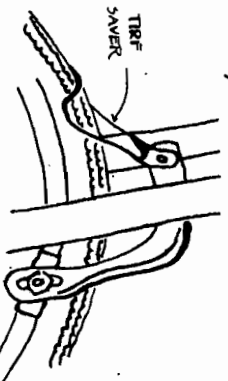
Brakes get funky and can be taken apart and cleaned. Hand brakes are easy, just watch how the spring(s) fit.



SEW-UP TIRES are fancy, lightweight tires with the tire sewn up around the tube and the tire glued to the rim. They take more air pressure than regular tires but are more likely to get flats and much harder to patch. You have to unglue the tire from the rim, find the leak, unsew the tire at that point, patch, sew, and glue.



PRESTA VALVES are found mainly on sew-up tires. They need special pumps or a "valve adapter" to let regular pumps fit. To put air in, loosen core locknut (A), then use pump. Screw locknut back down when you're done.



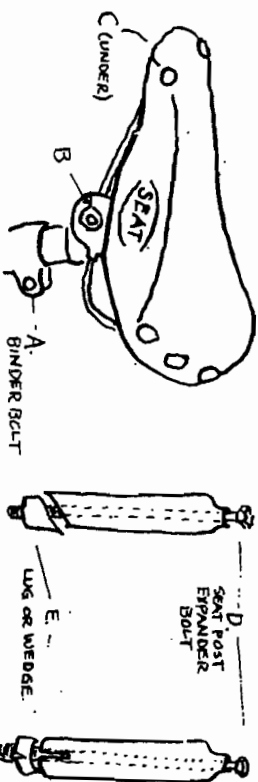
TIRE SAVERS (used on 10-speeds with sew-ups or thin tread tires) are pieces of wire that attach where the brake bolts on. They knock off pieces of glass and such before they dig in and cause a flat. They work!

SEAT

The main rule for where to adjust the seat and handlebars is so that they are comfortable for you. Try different adjustments—those adjustments can make a big difference in how you feel on your bike. "Proper" or "suggested" adjustments are supposed to balance weight to lessen strain and increase efficiency. You can get used to different positions and it might be worth trying to get used to one that makes riding easier.

The "suggested" height for the seat is so that when you sit on it with the ball of your foot on the lower pedal, your knee is just slightly bent. Or so that your leg is straight with your heel on the pedal.

TO ADJUST: The seat is attached to the seat post, which fits into the frame. You want to move the seat post. On some bikes (most 10-speeds) the adjustment is made with a nut (A) where the seat post goes into the frame. Loosen the nut and remove or adjust the seat post. If it sticks, use Liquid Wrench or oil—or bang it. You should always keep about 2" of the post in the frame. You can buy a longer seat post if you need to.



Other bikes have an "expander bolt" going in the top of the seat post. To adjust the height you have to remove the seat (loosen nut (B)) to get at the expander bolt. Then loosen the expander bolt (D) several turns (but not so that the bolt comes out) then bang it down into the seat post. This should loosen the lug or wedge at the other end (E) and let you move the post. Just loosening the expander bolt is useless—you have to bang it down. If you loosen the bolt too much, the wedge may just fall off inside the frame and you'll have to turn the bike upside down to shake it out. Get the seat post to the right height and tighten the expander bolt (D).

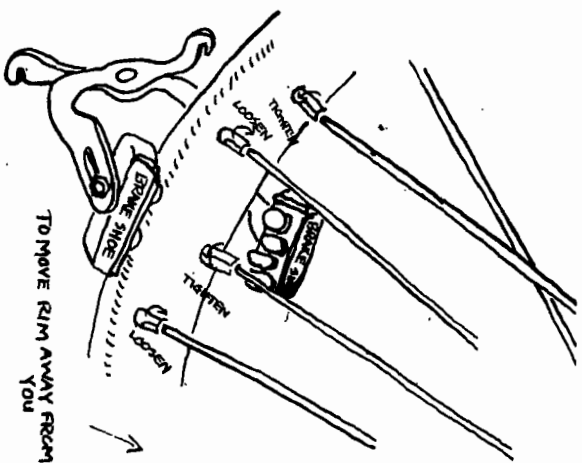
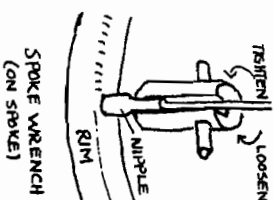
Seats have other adjustments. Most tilt. Right under the seat is the bolt (B) that holds the seat on the post. Loosen this to tilt the seat up or down.

Some seats (usually 10-speed) can go forward or backward which changes your position with relation to the pedals and handlebars. Adjust this with the same bolt (B) as the tilt. A good place for the seat is about 2" behind the hanger axle, farther back for long arms, forward for short arms.

Some seats also have a nut under the front of the seat (C) that controls how taut or saggy the seat is. Saddle soap will loosen up stiff new leather seats.

piece of chalk near the rim first on one side and then the other and spin the wheel. Where the chalk marks, the spoke nipple need turning.

The principle is to loosen the spokes that go to the side of the hub that the rim pulls towards and tighten the spokes to the other side. Turn nipples to loosen or tighten spokes. Remember Liquid Wrench if the nipples are tight. Let it soak in. Remember also that it will eat tires. If the spokes on the side the rim pulls towards are already loose, just tighten the other side. Otherwise loosen nipple a turn and tighten the other nipple a turn. Did that do anything? If not, try the same thing again. Do it little by little. Go one or two spokes in each direction from the one you just turned, turning the ones farther from the main spot less. Nipples turn clockwise to tighten (normal way) as you look at the head of the nipple but when trueing a wheel you almost always look from the other direction. That means that clockwise loosens.



Trueing a wheel can be frustrating work. If you get tired, stop and come back later. If you get messed up, it may be easier to loosen all the spokes and start again. It gets easier with practice—even plain simple.

When you're done, check to make sure the nipples don't stick out thru the rim. If you just built the rim (and started with a straight rim and the right size spokes) they shouldn't. If they

Hold the loose spokes and turn the wheel over. Repeat what you just did for (C) and then (D) spokes. The (C) spoke above (looking straight down at the wheel) a given (B) spoke should go next to that spoke on the rim. If it is a little counter-clockwise looking at the head (it will not be exactly above), it should go in the next hole counter-clockwise to the (B) spoke on the rim.

Keep trying until the pattern is right and uniform. All the nipples should be started.

TIGHTEN NIPPLES more, going around the rim in a circle. Try to do them evenly, like until the nipples reach the end of the thread on the spokes. If they seem to be getting too tight, loosen the ones you've done a turn or two. If they are too loose, tighten them all another turn or two. Then again, until all spokes seem tight (not too tight, that will pull the rim out of shape).

For the rear wheel on a 10-speed, give the freewheel side spokes 3-4 extra turns as you are tightening the spokes. This "dish" the wheel" is to get the rim centered with respect to the frame even tho the fat freewheel makes the hub not centered any more. If the spokes are already tight, loosen the non-freewheel ones 2 turns and tighten the freewheel side ones 2 turns (or until rim is centered).

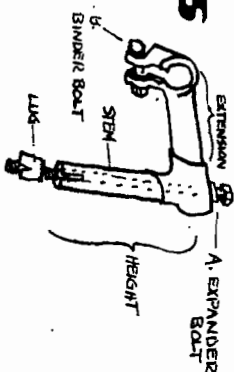
The rim should be pretty straight now if you tightened the spokes evenly and began with a straight rim. In any case, now you true the wheel.

TRUEING A WHEEL

You can do this with the wheel on the bike. If the adjustment is minor you can do it with tire and tube on. If not, it's best to take them off. If the spoke gets tightened so much that it sticks thru the nipple, it can puncture the tube. **RIM STRIPS** (rubber or cloth strip around the rim) are meant to protect your tube from this but they can't if a lot of spoke sticks thru.

You can use your brakes (hand brakes) to help true the wheel. Make sure brake is centered in the frame. Watch the brake rubbers as you spin the wheel slowly. If the wheel stays the same distance from the rubbers all the way around, your wheel is perfect. If not wait until the rim gets to a place where it is closer to one side. Stop the wheel there. If you don't have hand brakes, watch where the rim passes thru the frame. Or hold a

HANDLEBARS



Height or removal is controlled by an expander bolt (A) similar to that on some seat posts. Adjust it the same way.

Loosen the expander bolt (A) several turns, then bang it down to loosen the wedge. You can then remove handlebar stem or adjust height. Keep about 2 1/2" of the stem in the frame. You can get different size stems—different heights to raise the handlebars more and different extensions to change the distance of the handlebars from you (seat placement also affects this). A good height is about level with the seat.

The height adjustment also controls whether the handlebars are in line with the wheel. For loose handlebars (handlebars turn and wheel doesn't or vise versa), or if wheel points one way and handlebars another, turn expander bolt (A). If you can't tighten handlebars enough, the expander bolt or wedge may be broken. Remove handlebars and look at them.

Tilt is controlled by the binder bolt (B) that holds the handlebars in the stem.

BRAKES

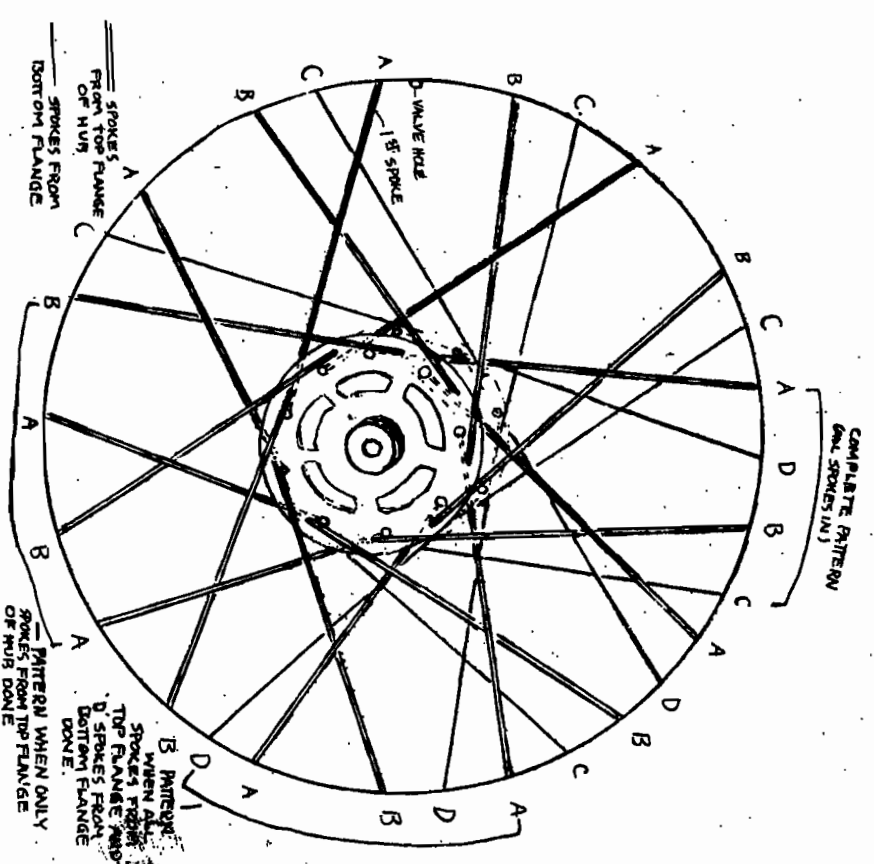
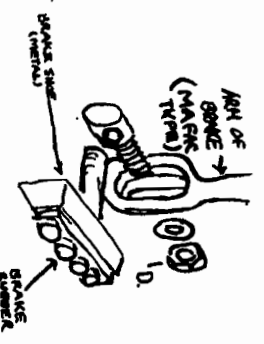
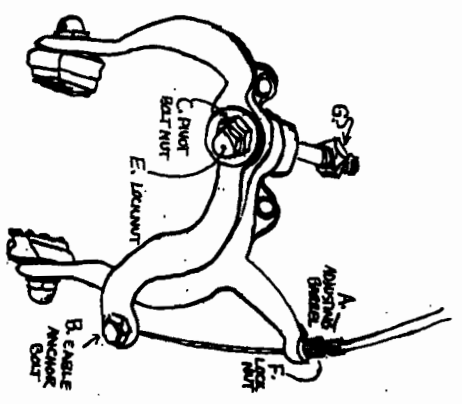
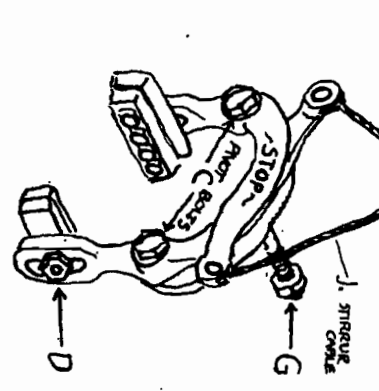
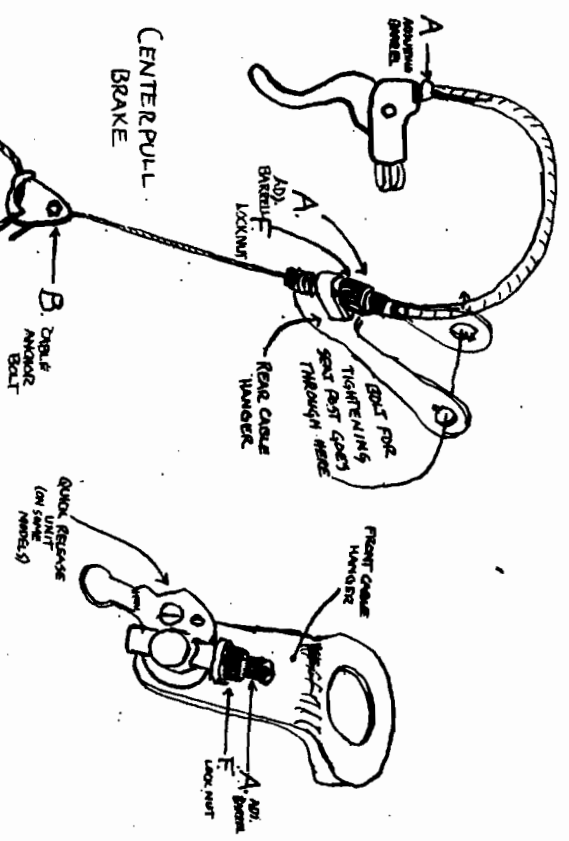
There are two main kinds of brakes:

COASTER BRAKE—a foot brake located in the rear hub and usually found on single speed bicycles but possible on 3-speeds. There is no simple adjustment for these. If they work poorly, they need to be taken apart, see p. 40. Make sure the brake arm (the metal bar that comes out of the hub and bolts to the frame) is on tight. If there is an oil fitting or a grease nipple on the hub, lubricate monthly. Otherwise overhaul once a year.

HAND BRAKES (caliper brakes) have levers on the handlebars that pull cables that pull rubber brake pads into contact with the wheel rim. There are two varieties of hand brakes: center-pull (found on most 10-speeds) and side-pull (found on 3-speeds and some 10-speeds. Both have many adjustments, and many things that can go wrong.

Put one spoke from group (A) in the rim and start the nipple.

Start it preferably in the first hole counter-clockwise from the valve hole but any hole will do (any hole toward the top if you have offset holes in the rim). Put the rest of (A) spokes in rim, going to every 4th hole (skip 3 in between). Turn rim so spokes are going clockwise if that hasn't already happened naturally.



Then do all (B) spokes, following the lacing pattern and going counter-clockwise. When you are done every other hole in the rim should be filled. Remember your lacing pattern. Over 3, under 1? Then for the first (B) spoke take any spoke and move it counter-clockwise over 3 spokes and then slip it under the 4th spoke you pass and into the middle hole in the rim between the 4th and 5th (A) spokes.

On some rims the holes are "offset"—not all in a straight line. Spokes from one side of the hub should go to rim holes on the same side.

BUILDING A WHEEL. If you are building a wheel from scratch you have to decide what size spokes to use and how to lace it. A good way to decide is to find a similar wheel with the same size rim and hubs (there are small flange and large flange hubs). Measure those spokes and lace your wheel the same way. A standard way to lace a 10-speed is with 12 1/8" or 12 1/16" spokes, 27" rim, and large flange hubs. Have each spoke go under 3 others and over 1 (or over 3 and under 1, depending on how you look at it).

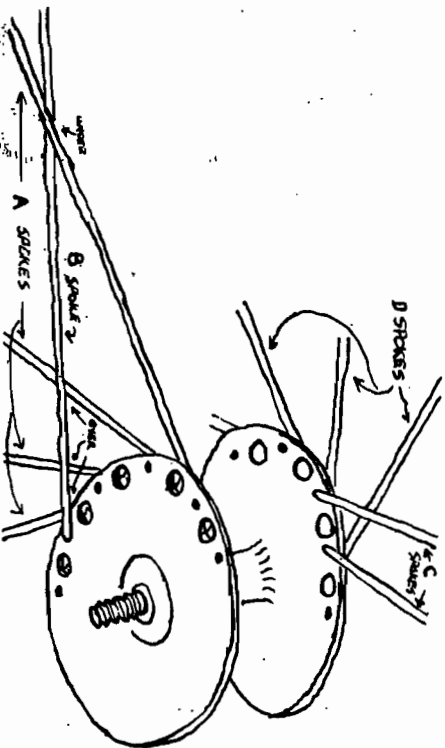


PUT SPOKES IN thru the hub facing alternating directions.

If your hub has countersunk holes only on one side, the spoke heads go on the non-countersunk side. Lay the hub and spokes on the floor with one end of the hub up and the spokes fanned out around. It'll be a mess—patience.

LACING THE WHEEL (ONE METHOD). After the spokes are all in the hub, divide them into four groups:

- (A) spokes going down from top part of hub (heads out)
- (B) spokes going up from top part of hub (heads in)
- (C) spokes going up from bottom part of hub (heads out)
- (D) spokes going down from bottom part of hub (heads in)



Common hand brake problems:

- 1) **BRAKE SHOES** may be too far from the rim so the brakes never catch well or too close so they rub. They should be about 1/8" from the rim.

When there is a long "adjusting barrel" (A) along the cable (either by the hand lever, by the brake, or on the cable hanger) use that for adjustment if possible. Screw it out (up) to tighten the cable and move the brake shoes closer to the rim. Move locknut (F) to keep barrel in the desired position.

If that doesn't adjust the brakes enough, loosen the cable anchor bolt (B) and adjust there. To tighten the cable at (B) you need three hands—or a clamp or piece of rope to hold the brake together while you pull the cable and tighten the nut.

With Mafac-type brakes you can adjust this using bolt (D).
 2) **BRAKE RUBBERS** may be worn and need to be replaced.

Sizes differ, make sure to get the right size. Slide (or pry and pull) the old rubber out and slide the new one in. **IMPORTANT**—make sure that the open end of the brake shoe (metal holder that the rubber fits into) is facing the rear of the bike. Otherwise the rubber can just be pushed out by pressure of the wheel and you'll have no brakes.

3) **BRAKE SHOES** may not be at the right height. They should hit squarely on the wheel rim—not the tire (that will wear out the tire fast). Loosen nut (D) to adjust. Some brakes (Mafac type) have another adjustment at (D) to change the angle of the brake as well as the height.

4) **BRAKES MAY NOT BE CENTERED.** This will cause the brake to rub more on one side. Loosen nut (G) that holds the brake to the frame and straighten brake.



5) **SPRING** may not be centered (mainly side-pull brakes). This causes one side to rub more. Loosen nut (G) and push or pull on spring until spring is even and pushes on both sides of the brake (brake arms) evenly. Retighten (G).

6) **WHEEL** may not be centered or it may not be "true" (see p. 36). That will cause the brake rubbers to hit unevenly. To center wheel: loosen axle nuts, hold wheel centered in the frame as you retighten axle nuts.

7) **RIM** may not be clean, which can cause uneven grabbing or squeaking (squeaking itself doesn't hurt bike). Make sure the rim is free of dirt and oil. You can use alcohol to clean the rim—it won't hurt rubber like kerosene. The rim may have

kinks in it (see p. 32) which can cause grabbing.

8) **BRAKE MAY BE LOOSE.** This will cause jerky grabbing. Tighten (G) that holds brake to frame. Brake arms may also be loose. Tighten pivot bolt(s) (C). Don't get them too tight—brake won't work.

9) **BRAKE CABLE** may not be sliding easily thru the cable casing, either because it is too big for the casing (or the casing too small for it), the cable is rubbing on a kink in the casing, a loop in the casing is too big, the cable is frayed, or it needs oil or grease. You can usually drip oil into the casing without removing the cable. Or the cable may be broken. When buying a new cable you need to know whether you need a ball end  (most 10-speeds) or a barrel end . Look where the cable attaches to the lever.

TO REPLACE BRAKE CABLE: Loosen cable anchor bolt (B) and pull the cable out from the hand lever end. Note how it attaches to the lever. Put new cable thru, starting at the lever, greasing it lightly where it goes thru casing. Check the casing for kinks or jagged ends. Make sure cable casing sections have proper curve, not straight and not too big a loop. Now go back to 1) and adjust the brakes.

10) **BRAKE LEVER** may be sticking, because of lack of oil or a bent part. Try oil first. Bent parts can often be straightened—carefully because metal bent too much can break.

11) **BRAKE** may be sticking. This can be due to lack of oil, general funkiness, pivot bolt(s) (C) too tight, or a bent part (like the brake arms). Try cleaning, loosening pivot bolt(s) slightly.

Center-pull brakes have 2 pivot bolts, one side too tight can cause one shoe to rub. Side-pull brakes sometimes have a screw at (C) or more often have both a nut and an acorn-shaped locknut (E). Loosen locknut, adjust nut, tighten locknut. To take the brake apart, see p. 38.

12) **BRAKE LEVER** may be loose on handlebars. If the nut that holds lever on is visible, just tighten it. If it isn't, it is inside the lever and you probably have to loosen the cable to reach it. Loosen cable, either with the quick-release lever if that works enough, by unhooking the short "strut cable" (J), or by loosening the cable anchor bolt (B) on the brake. Try not to let the cable slip all the way thru the anchor bolt—it's sometimes hard to put back, especially when frayed. With the cable out of the way, reach in with a screwdriver or socket wrench (Mafac

nipple on and screw it down. The nipple works like a nut and you can use a screwdriver (if the nipple has a slot on it), spoke wrench, or if necessary an adjustable crescent wrench (crescent wrench should be just for emergencies as it tends to strip the nipple).

Make sure the wheel is true (see p. 36) and no spokes stick up thru the nipples. Cut off or file down extra if spoke sticks thru. Replace rim strip, tube, and tire.

SPOKING A WHEEL

Here's the procedure for taking off a rim and putting on a new one or building up a wheel from scratch (when you have hub, spokes, and rim).

Before you take anything apart—take a good look at how the wheel is "laced", how the spokes go, the pattern they make. How many spokes does each one cross? Do they go under and over? Is it the same as your other wheel? Then you can use that as a model.

TAKING OFF RIM: Take off the tire, tube, and rim strip. For a 10-speed rear wheel, remove the freewheel at this point (see p. 46). It is much harder to remove the freewheel once the spokes are removed. You want to undo all the spokes. The nipple that goes thru the rim screws on to the spoke. Unscrew them all. For tight, rusty ones, squirt in Liquid Wrench. Careful, you can break a good spoke trying to unscrew the nipple. Also make sure you unscrew in the right direction—counter-clockwise as you look at the head of the nipple (careful tho, you usually look at it from the other end). If your spokes are rusty or bent and need replacing, you can just clip them all with a wire cutter.

If you are just replacing the rim, you'll save a lot of time and trouble by not messing up the order of the spokes. Loosen all the nipples until they are almost off. Then put the wheel down flat and lay the new rim on top of the old one, lining up the valve hole and making sure offset holes (if you have them) correspond. Tie the two rims together in 2-3 places. Doing one spoke at a time, take the nipple the rest of the way off and move the spoke to the hole in the new rim right above. Start the nipple on. Do the rest of the spokes the same way. Skip to **TIGHTEN NIPPLES**, p. 36 .

WHEELS

If the wheel is just warped, no big kinks or dents, you can probably just "true" the wheel (adjust the tightness of the spokes to make the wheel straight and round), see p. 36. If your rim is too warped or bent or has bad kinks, you may not be able to straighten it and you will have to take the rim off and replace it, see p. 33.

KINKS. If there are kinks or dents you want to get out, take off the tire and tube and you may be able to straighten them (carefully!) with vise grips, pliers, or a hammer. Kinks are bad if they are big enough to make it impossible to true the wheel, if the tire refuses to stay in the rim at that point (and pops out and you get a blowout), or if hand brakes catch on the kinks and always stop the rim at the same place (which will lead to a worn spot on the tire and finally a hole).

Kinks and dents come from riding over curbs, holes, and bumps. Avoid that. If you get dents regularly (maybe you are tall or heavy or ride bumpy roads) it might be worth putting on more solid rims. Schwinn makes sturdy ones. Maybe you just need more air in your tires.

SPOKES

Spokes can be easy to put in. The hardest part is getting enough room to get the spoke thru its little hole and to its proper place on the rim without bending it all up. To get some 10-speed spokes in you have to remove the freewheel (which is usually on very tight and requires a special tool, see p. 46). Sprockets on 1 and 3-speeds are easier to get off. Many are held on by a round wire clip. Pry it off with a screwdriver.

If you are just replacing a spoke, you still have to take off the tire, tube, and rim strip to put the spoke nipple in. If the nipple is still in place you don't. Take out the old, broken spoke and get the correct size replacement. Spokes come in a lot of different sizes, measure another spoke carefully. All spokes on a wheel must be the same size.

Put the spoke thru the empty hole in the hub, facing the opposite way from the spokes on either side of it. Make the spoke go to the proper hole on the rim, making it go over and under other spokes if your wheel works that way. Put the spoke

brakes). Tighten and reconnect brakes.

This is also the procedure if you want to change the location of the levers (and you might, especially on a 10-speed—get them so they are comfortable for you).

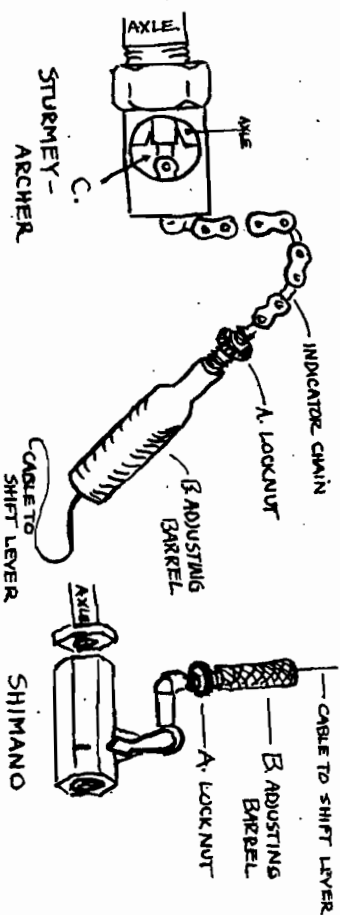
With **TAPED HANDLEBARS** you have to undo the tape to move the levers. Pull out the handlebar end plugs and unwind tape. Plastic tape has no adhesive and cloth tape has little.

Careful not to undo the bolt on the brake lever all the way—it's hard to get back on. Just loosen a little and move lever.

Rewind tape, beginning near center of handlebars, shove extra in end of handlebars, and replace end plug.

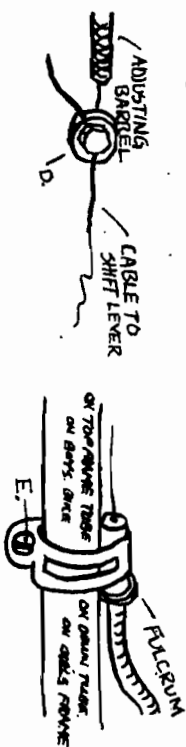
GEARS—3 SPEED

These have a trigger on the handlebar (usually Sturmey-Archer) or a handgrip (Shimano or Sturmey-Archer) that turns with 3 places where it catches. Pulling the trigger or turning the handgrip pulls the cable tighter (or loosens it) which changes the gears inside the rear hub. If the cable isn't adjusted to the proper length, the gears won't work right—the pedals may turn without engaging or the bike may not have all 3 gears. There is an "adjusting barrel" (B) where the cable attaches to the indicator or indicator chain near the rear hub.



TO ADJUST: Put the bike in middle gear. Loosen locknut (A). For Sturmey-Archer gears, turn the adjusting barrel so that point (C) where the indicator chain becomes a rod is even with the end of the axle (look thru the hole in the nut). For Shimano gears the pointer should point to the mark on the indicator or "N" should be visible thru the hole in the indicator. Remember this is in middle gear.

You might not be able to adjust the cable enough by this method. If not, there are other places to adjust it. Some cables have a place to adjust right before you get to the adjusting barrel. Loosen nut (D) and adjust so there is no slack (but not so it is tight) in loosest gear. Now do first adjustment above.



If you don't have that adjustment, follow the cable from the handlebar down toward the rear hub. Find the "fulcrum", where the covered cable ends and the plain wire begins. Loosen nut (E) and move the fulcrum along the frame—toward the front of the bike if the cable was too loose, toward the back if it was too tight. Get it so there is no slack in the loosest gear. Tighten (E). Now do first adjustment above.

TO REPLACE CABLE: Cables break and need to be replaced. Undo the adjusting barrel (B) near hub. Unhook cable from fulcrum and pulley. For trigger on handlebar, push loose cable forward until end can be unhooked from trigger. Pull it out. Notice how it goes so you can put the new one thru. For handgrip, you have to take it apart (one or two screws). Be careful not to lose the little ball bearing inside.

GEARS ~ 10 SPEED

The principle of a 10-speed bike is to change the ratio of how often the pedals go around to how often the wheel turns by changing the size of the sprockets that the chain goes around. Ten-speeds have 2 sprockets in front ("chainwheel") and 5 on the rear hub ("freewheel"). That gives you 10 combinations. Five-speeds have only one chainwheel in front, 15-speeds have a triple chainwheel.

There is a derailleur (which comes from the French word for "to untrail") both front and rear that moves the chain from one sprocket to another. There are adjustments to control how far in each direction the derailleur moves, so the derailleur moves the chain to all the sprockets but not off either end. The rear derailleur also takes up extra slack in the chain.

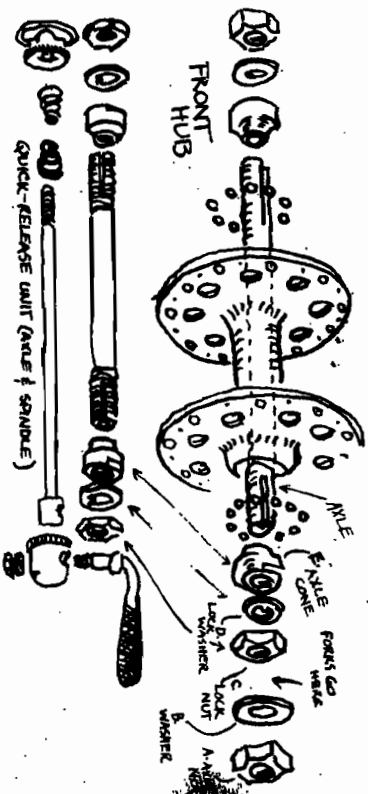
TO TAKE APART front hub: Take wheel off bike and remove the outer axle nut (A) and washer (B) on one side. If there is no washer, preferably a serrated grip washer, get one soon (especially for the rear wheel)—your wheel will stay in place better. You only have to undo one side of the hub unless you are replacing a stripped or bent axle.

For "quick-release" hubs (some 10-speeds), unscrew and pull out the quick-release assembly and then proceed. When putting it back, make sure the little springs face the right way (small part inward).

Hold the axle cone (E) with a cone spanner (a very thin wrench) and loosen locknut (C). Remove locknut, lockwasher (D), and axle cone (E). Some bikes (usually 1-speed) don't have a locknut and lockwasher but instead use the forks as a lockwasher and the axle nut as a locknut.

Once the cone is out, the bearings will come out. Count them. Pull out axle from other end to get the rest of the bearings. Clean the bearings and hub, check for bent axle or messed up threads on the axle, worn or missing parts. Grease, reassemble, and adjust.

Rear hubs will also have these bearings and you can get to them without messing with the other stuff. Do.



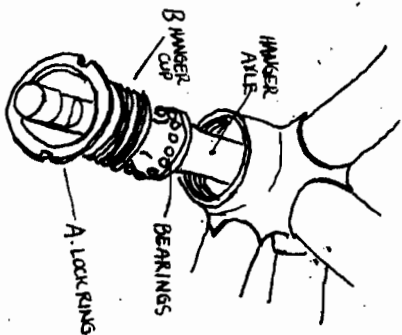
TO ADJUST HUBS: Turn axle cone (E) until there is no extra play but wheel turns freely. Hold wheel in front of you with one hand on each end of the axle and spin the wheel. If it scrunches, it's too tight. Hold wheel and wiggle axle. If it wiggles, it's too loose. When it's right, put lockwasher (D) in position and tighten locknut (C) (while holding cone with cone spanner so it doesn't change position). Spin wheel again to make sure it is right.

HANGER

TO REMOVE HANGER: Cranks should be off, except with "one-piece" cranks. Loosen locking on the left side (A) (use vise grips, hammer and punch, or special tool), then undo the hanger cup (B). Careful, these may have left-hand thread and unscrew clockwise. That should expose one set of bearings. Take them out and count them. Pull out the axle and you can reach the bearings on the right side. There is no need to undo the right hanger cup.

If you have a "one-piece" crank, remove the left pedal. Then undo locking and cup as above and pull everything out from the right side. The bearings will usually be in retainers to make things easier.

Check for wear, clean, grease, and reassemble. When you replace axle, make sure long end is on the chainwheel side.



TO ADJUST HANGER: Turn hanger cup (B) until axle rotates freely but without extra play. Tighten locking (A) and check again.

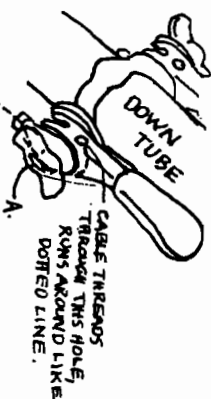
HUB

Front hubs are simple. Rear hubs will have extra stuff, either a coaster brake or 3-speed gears inside the hub or a freewheel next to it, but they also have bearings like the front hub.

You shift gears by moving the shift levers, usually mounted on the frame or handlebars. There are no fixed positions to tell you when the bike is in gear as on a 3-speed. As you move the lever, the cable gets tighter or looser and the derailleur moves the chain from one sprocket to the next. You soon learn to hear and feel when you are in gear—it scrapes, crunches, and rubs otherwise. Don't panic if that happens—just move the lever a little. But don't let the crunching continue.

Shift gears while pedaling, but not pedaling hard. **DO NOT** shift while freewheeling (coasting) or standing still. That puts too much strain on the cable and/or derailleur. The derailleur can't move the chain to the next sprocket if the sprockets aren't turning.

SHIFT LEVERS. There should be an adjustment on the shift lever (A), sometimes just a screw, sometimes a thing you can turn by hand (far better). This controls how easily the shift lever shifts. It should be loose enough to shift easily but if it is too loose the lever won't hold in place and the bike won't stay in gear. This may need adjusting often, learn to do it as you ride.



TO REPLACE GEAR CABLE: Undo cable anchor bolt (C) on derailleur, pull cable out, and unhook it from the shift lever (you may have to undo screw (A) on shift lever and remove the lever to get cable out, i. e. Hurst lever). Put new cable thru. Make sure to get one with the same kind of end as the old one. Remember to grease the new cable lightly where it goes thru the casing. Check cable casing for kinks or jagged ends and proper curves. Where cable casing curves, curve should be gentle—not too big or too little. If a cable ever breaks near an anchor bolt, you can often do a temporary emergency repair by shortening the casing which will lengthen cable.

TO ADJUST CABLE: Loosen cable anchor bolt (C) on the derailleur and pull cable so there is no slack (with lever so cable is loosest). Tighten cable anchor bolt. If cable is too loose,

derailleur won't go on large sprocket. If cable is too tight, it won't go back to small sprocket. Careful with cable anchor bolts, they break easily.

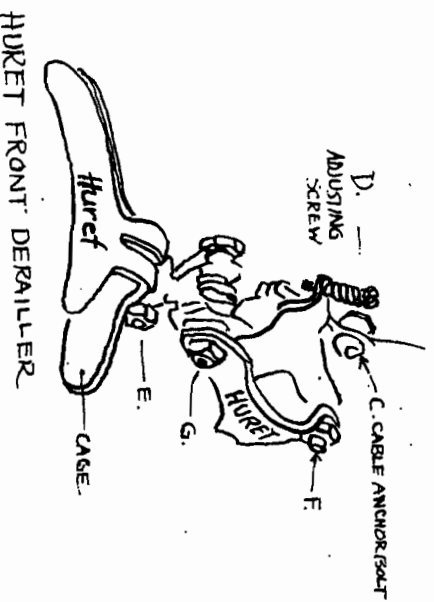
New cables may stretch for a while and you'll have to do this adjustment several times with a new bike or cable. You may need to readjust derailleur after adjusting cable.

ADJUSTING DERAILLERS: This is usually easier to do with the bike upside down so you can pedal and test your adjustments.

There are five major makes of derailleurs: Huret, Simplex, Campagnolo, Shimano, and Suntour. Most bikes use one of these. They will all need adjusting and can be adjusted easily. The

places to adjust vary on different makes and models but the idea is the same. I'll explain one Huret model in more detail and give diagrams of some other derailleurs. I won't cover them all because there are too many and if you know the principle you should be able to find the adjusting screws.

FRONT DERAILLER: (F) and (G) control the derailleur's position on the frame. The derailleur cage should be parallel to the chainwheel and should clear the large chainwheel by about 1/4". With the shift lever so that the cable is loosest (but no slack), the derailleur cage should be centered over the small chainwheel. Loosen (E) and move cage until it is over small chainwheel. Careful, bolt (E) strips or breaks easily. Some derailleurs have two adjusting screws (new Huret does too) and there is another screw similar to (D) to adjust derailleur over the small chainwheel (see p. 22).



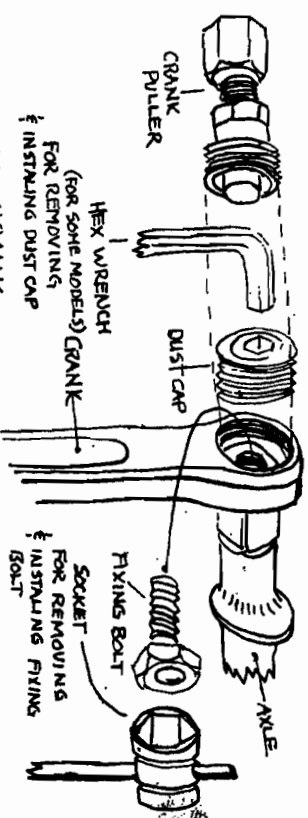
HURET FRONT DERAILLER

TO REPLACE CRANK: Put crank on hanger axle so that crank is flush with end of axle and so the flat part of the axle is lined up with the hole in the crank. Put the cotter key in with the flat side toward the axle. Hammer the cotter key in (remember the block of wood under the crank) until it is tight and there is no play between crank and axle. Put on the washer and nut (not too tight, they strip easily).

Cotter keys come in different sizes—take your old one to get a replacement (9.5mm is standard, 9.0mm for french bikes). Often you have to file or grind down the flat part of a new cotter key to get a good fit and have enough room for the nut to go on.

TO ADJUST CRANK: If there is play between the crank and hanger axle (hold one crank in each hand and try to turn in opposite directions to find play), hammer cotter key in more (resting crank on block of wood) and tighten nut down: DO NOT try to pull cotter key thru by tightening the nut—it will strip.

For a BENT CRANK, remove pedal and slip a piece of pipe over the end of the crank. Pull the pipe (and thus the crank) out gently. Be careful.



COTTERLESS CRANK

COTTERLESS CRANKS found on expensive 10-speeds need special tools. Remove dust-cap (E) and undo bolt (F) with the special installer tool. Then screw the extractor tool into the dust-cap threads in the crank (with the bolt on the tool (G) screwed out). Slowly turn bolt (G) in, with installer tool, which will push crank off the hanger axle. Be gentle—it may be on very tight.

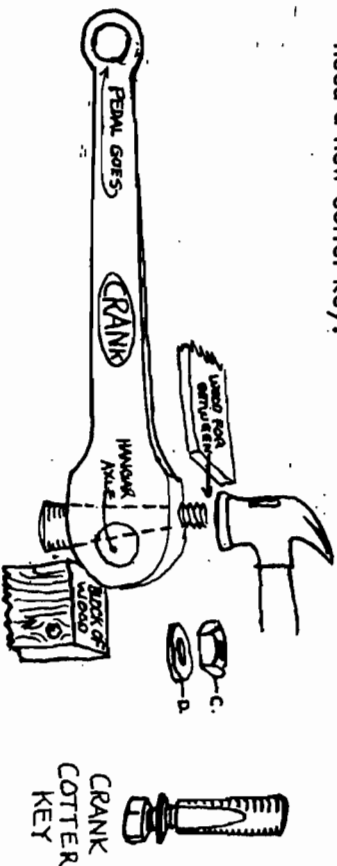
To replace crank, put crank on axle. Put bolt (F) in end of axle and tighten slowly, wiggling crank as you go to get it on snug. Replace dust-cap.

on the pedal. They let you pull up as well as push down and around when you pedal. You can adjust the strap and bend the metal part to change how tightly the toe clip holds your foot. It should be looser for city riding where you have lots of stops. Toe clips come in different sizes—get one that keeps the ball of your foot on the pedal.

CRANK

If your cranks come off the hanger axle, you will have to remove them to get at the hanger bearings. For "one-piece" cranks (American bikes) see HANGER section, p. 30. You don't have to remove the pedals or chainwheel to remove the cranks.

TO REMOVE CRANK held on by cotter key: Undo crank cotter key nut (C) and remove washer (D). Then you want to bang out the cotter key with a hammer—but without damaging it or the hanger bearings. Place a piece of wood over the threaded end of the cotter key (or use a punch or turn the nut out so it is flush with the end of the cotter key) so as not to damage the threads. If you damage them the nut won't go back on and you'll need a new cotter key.



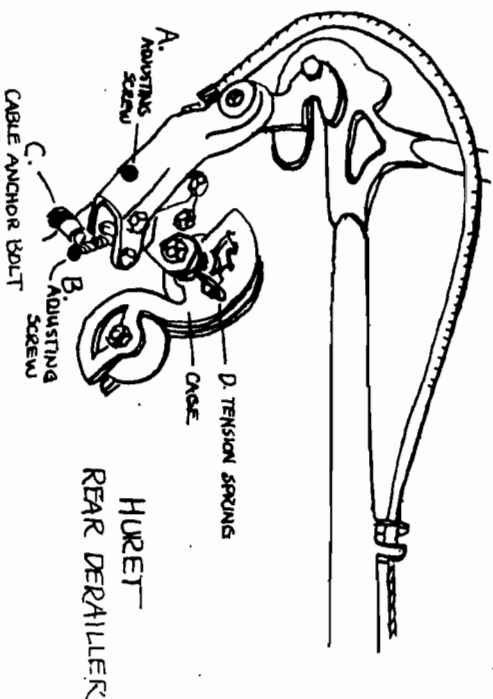
Also, so you don't mess up the hanger bearings, rest the crank on a piece of metal or hard wood when you hammer (so the crank gets knocked against that and not the hanger bearings). Cotter keys are almost always hard to get out. They are usually very tight. Try Liquid Wrench. If you still can't do it, forget the block of wood to protect the threads and smash (gently) the cotter key directly. You'll probably mess up the threads (and have to get a new cotter key and maybe file the flat side down to fit right) but you'll probably get it out. Once the cotter key is out, the crank will slide off the hanger axle.

Move the shift lever until the cable is tight (just until it stops, don't force it). Remember, don't shift unless pedaling. Adjust (D) until derailleur cage is centered above large chainwheel. When riding, if the chain comes off the front derailleur (which it seems to like to do often) it means that the front derailleur is out of adjustment. Adjust (E) if it comes off inside and (D) if it comes off outside.

REAR DERAILLER: With shift lever so the cable is loosest (but no slack), adjust screw (A) so the derailleur is centered over small sprocket (high gear). Move the shift lever so the cable is as tight as possible and adjust (B) so derailleur is centered over large sprocket (low gear). If the chain comes off the freewheel while riding, the rear derailleur is moving the chain over too far. Adjust (A) if it comes off outside or (B) if it goes too far inside.

If the derailleur goes too far inside, it can really mess up your spokes and derailleur—unless you have a SPOKEGUARD, a plastic or metal disc that fits between the freewheel and the spokes. It's something you should have. To put it on you have to remove the freewheel, see p. 46.

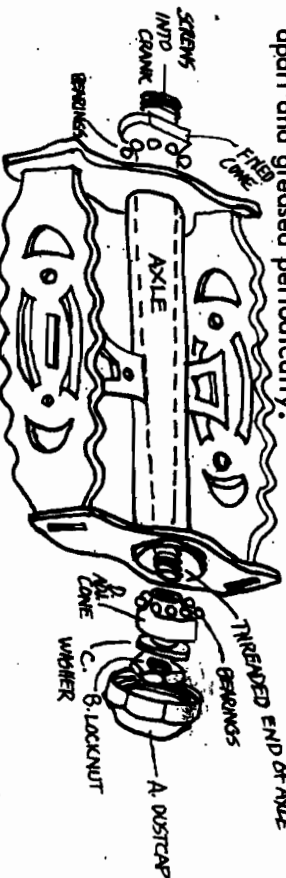
The chain tension can be adjusted by moving spring (D) to one of the tension slots (little hooks) on the outer cage. Other derailleurs have different tension adjustments but always near the tension spring (the spring near where the cage attaches to the body of the derailleur).



PEDALS

Pedals screw into the crank. Right and left pedals have different threads and aren't interchangeable. Right pedal has normal right-hand thread but left pedal has left-hand thread that screws in counter-clockwise. Pedals should be on very tight, otherwise the threads get stripped and you may have to get a whole new crank. A regular wrench sometimes won't fit in the space between the pedal and the crank and you'll need a special thin wrench. Maybe you can file one down to fit. If you need new pedals get the right kind of thread for your crank (French, English, or American).

Most pedals have bearings inside which need to be taken apart and greased periodically.



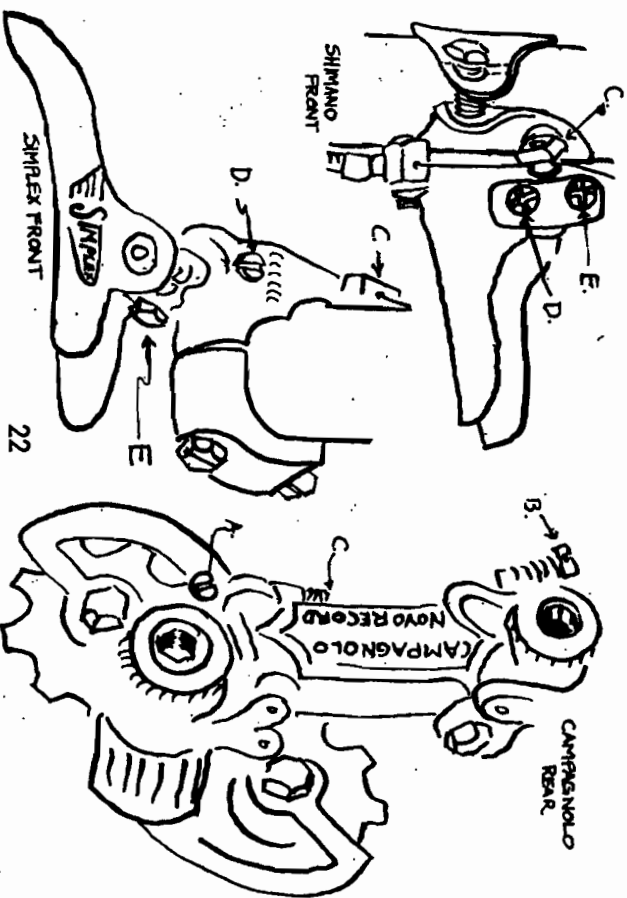
TO TAKE APART: If you have a removable dust-cap (A), unscrew it or pry it off. Remove locknut (B), lockwasher (C), and adjusting cone (D). If you don't have a removable dust-cap you have to take off the two pedal rubbers to reach the locknut and adjusting cone.

Pedals are an exception to the general rule that bearings come in matched sets. Because the pedal axle is tapered, the two sets of bearings have different amounts of balls. Take your pedal apart carefully and count balls. Write it down. Clean and reassemble.

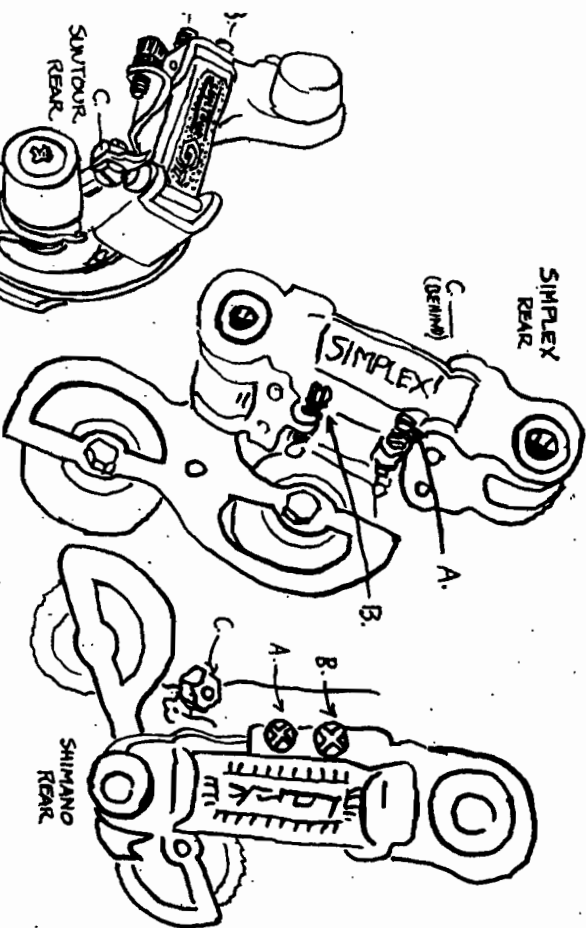
TO ADJUST: Screw in adjusting cone so that the pedals turn freely but without extra play. Tighten locknut. Test it.



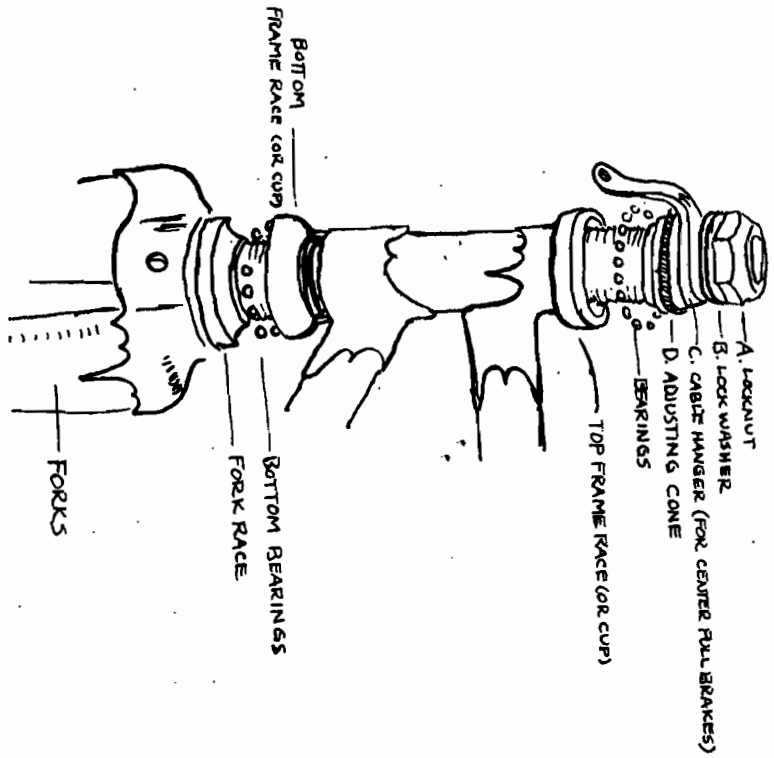
TOE CLIPS really help when riding. They bolt to the metal "rat-trap" pedals found on 10-speeds and hold your foot in place



rear derailleur adjusting screws:
 A - high gear—small sprocket
 B - low gear—large sprocket
 front derailleur adjusting screws:
 D - high gear—large sprocket
 E - low gear—small sprocket
 C - cable adjustment



Hold the fork in the frame until the adjusting cone (D) is all the way off—then you can deal with the balls (if you have retainers less care is needed). Still holding the fork in the frame, turn the whole thing so the top set of balls falls into a neat pile (in a box or on a rag makes it easier). Count them. Then remove the forks and let the bottom set of balls fall into another neat pile and count them. There should be the same number top and bottom. If not, make sure there are when you put it together again. If the balls all spilled immediately and got lost, don't panic. See p. 24 for how to figure out the number of balls.



Clean, check bearings and races (the parts on either side of the bearings) for wear. Replace missing or worn parts. Races can be pried or pushed off if necessary. They do not need to be removed unless worn or you're replacing the forks. Head parts must match (both the type of thread and the curves of the races) so if you need to replace one part get an exact replacement or change everything.

OVERHAUL & MAJOR THINGS

Periodically, maybe every 6-12 months, you should take your bike apart, clean it thoroughly, and repack the bearings with grease. Here is most of what you will have to know to do that. Or if anything goes wrong and you need to take one thing on the bike apart, this should help you. This section assumes you know what has been covered in the first section. Refer back if you need to.

It is a good idea to check all the adjustments in this and the first section on a new bike and periodically on an old one.

CLEANING. Get all the grit and dirty grease out. A solvent like kerosene (available at gas stations) cuts grease. Sometimes you want to just dump parts in a can of kerosene and let them soak. Sometimes it's nice to have a small oil can full of kerosene so you can squirt and wash away crud in hard-to-reach places. Also a toothbrush or small, stiff paintbrush can help scrape crud off. Wipe clean and let dry. Chains can be soaked in kerosene.

DON'T get kerosene or oil on rubber, i. e. tires or brake rubbers.

You might want to take the whole bike apart at once (careful to put each set of parts separate), clean it all, and then reassemble. Or you might want to clean one part and put it back together before going on to the next. Tape parts together with masking tape or draw pictures if you are afraid you'll forget the order of things.

BEARINGS



Many parts of the bike have bearings (head, hanger, hubs, pedals, derailleur) so I'll go into those first. Ball bearings are a series of steel balls. Instead of metal scrunching or sliding directly against another metal surface, the balls roll in between to reduce friction. Sometimes the balls are loose (most all but American bikes), sometimes they are held in a circle by a metal or plastic ring, called a retainer or cage, leaving the balls free to turn.

Bearings are usually found in matched pairs—exceptions are pedals where there are different amounts of balls at either end and some derailleur wheels that have only one set of bearings.

RETAINERS are much easier to work with—you don't have to worry about a whole mess of balls rolling all over the floor when you take something apart. But be careful, some balls may come out. The retainer part sometimes breaks—sometimes just enough to let a ball or two fall out, sometimes it gets totally chewed up and all you have are a few balls. If it is broken, get another one. You can also replace a retainer with just balls—use the same size balls as were in the retainer, just add more. Notice which way the retainer goes in, usually the solid side goes against the cone, ball side against the cup.

HOW MANY BALLS? If you have loose balls, it is sometimes hard to know how many you should have. The rule of thumb is one less than it takes to fill the space. Consider how the balls will be when the parts are together. Will the balls be pushed to the outside of the cup? If so, count how many balls it takes to fill the space with the balls pushed to the outside (grease will hold the balls in position.)

Write it down. When you take something apart with balls, do it carefully. Count the balls in each place and write it down.

If you find different size balls or retainers in corresponding places, something is wrong. Change it. Balls are cheap but important.

A hint on replacing balls. Grease the place they are to go first—then you can just sit the balls in (on the greased end of a screwdriver for hard-to-reach places) and they stay where they should.

WORN BEARINGS. Bearings are worn (and need replacing) if the retainer (if there is one) is broken or bent; the balls are rusty, pitted, or not smooth; or the races (cups or cones that go on either side of the balls) are pitted or not smooth.

ADJUSTING BEARINGS: The basic principle is to tighten the adjusting cone or cup (whatever part holds the bearings in) until the part turns freely but without extra play. Try different adjustments—after a while you'll get the feel of it. Try tightening the cone a little too much and then backing slowly off, testing often. When it stops scrunching should be just right. If your bike is poorly made it may be hard to get neither play nor scrunching. A little play is better than scrunching if you have to choose.

Tightening a locknut or locking down can change the bearing adjustment so hold the cone while you tighten the locknut and always check when you are done to make sure the adjustment is still right.

Some places (Simplex derailleur wheels and some pedals) have "sleeve" bearings instead of ball bearings. That's just a plastic or smooth metal band. Clean and lubricate like ball bearings. Sealed radial bearings (used in Phil Wood hubs and hangers) need neither lubrication nor adjustment.

HEAD

The head (where the front forks go thru the frame) has bearings at either end (loose balls or retainers). Take it apart carefully—the balls are small and tend to roll all over, especially since some come out upward and some downward.

TO TAKE APART: Take out the handlebar stem and handlebars (see p. 13). Loosen and remove locknut (A), remove lockwasher (B) (likely to have a point that fits into a groove in the forks) and cable hanger (for center-pull brakes), and loosen and remove adjusting cone (D).