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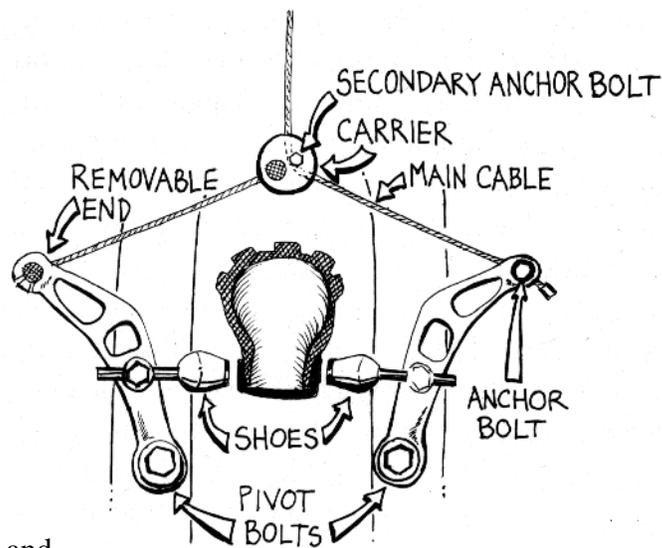


Cantilever Brakes

Part One - Planning

I. Objectives

- Student can identify a pair of cantilever brakes in need of adjustment.
- Student can name the different parts of various cantilever brakes and the tools used to fix them.
- Student becomes more familiar with concepts of parallel and perpendicular.
- Student becomes more familiar with the physics concepts of friction, surface area, and leverage.
- Student can describe all the major steps for assembly and adjustment of cantilever brakes.



II. Materials Needed

Demonstration Parts

Fork w/ cantilever posts
Full set of "canti" brakes
Brake lever
Cable
Housing

Tools

Box End and Adj. Wrenches
Allen Wrenches
Screwdrivers
Fourth Hand

Other Materials

Grease
Oil
Lock tight
Rags and Aprons
Sand Paper
Degreaser

III. Setting Workshop, with tool benches, bike repair stand, and bike storage.

IV. Evaluation

- Teacher Observation During Work Session Rotate amongst the students as you work. Observe for general mechanics skills (e.g. tool confidence and body position during tool use), work habits (e.g. keeping parts orderly, replacing tools), and ability to follow the steps of the process in the proper order. Observe for problem solving skills: Is student using visual observations? Is student able to pose questions whose answers will help him or her come up with a solution?
- Oral review at end of work session
 - Language: How many of the parts and specialty tools can students identify? Passively? Actively?
 - Systems: Can the student say what components are part of the system on which we worked? How do the components function as a whole?
 - Process: How many of the steps of the process can students name? Can they get the steps in correct order?
- Written Evaluation How well can student narrate what they did that day on their time sheet?



Part Two - Activity Instructions

I. Tool Check! Students & instructors enter the tool area and confirm as a group that all the tools are there.

II. Process

A. **Goal**— What are we trying to get done when we overhaul and adjust cantilever brakes? What does it mean to have properly adjusted brakes? Have you ever ridden a bike where the brakes were too loose? Too tight? What happened? How do the brakes affect the performance of the bicycle? What other factors may affect the performance of your brakes?

A well done brake adjustment or overhaul makes sure that:

- The hub of the wheel is properly adjusted.
- The wheel is true.
- The brake pads touch evenly on the rim and do not rub while brakes are not engaged.
- The brakes are not too loose.
- Both brake pads are “Toed” evenly.
- Brakes do not squeal!!!

B. **Steps to Overhauling and Adjusting Cantilever Brakes**— Go over each step of the process. Then, describe each step to the students and have them each carry out that step on their bikes before you move the group onto the next step.

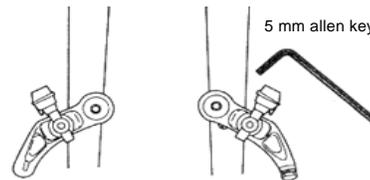
1. Evaluate condition of as many parts as possible before disassembly.

- a. Check the adjustment of the hub. If your hub is loose then it is impossible for the rim to move through a fixed circle (it can wobble from side to side). If the rim does not move through a fixed circle the brakes cannot be properly adjusted.
- b. Check if wheel is true. If the wheel is not true it is impossible to align the brake pads with the rim.
- c. Pads? Are the pads worn or worn unevenly? Can they be used again or must they be replaced?
- d. Cantilever arms? Are the springs in good condition? What about the spring casings?
- e. Brake levers? Do they pivot easily? Are any parts broken or missing?
- f. Cables and housing? Is the cable frayed or rusted? Is the housing cracked?

2. Decide if brakes need to be disassembled and readjusted. If all parts of the brakes seem to be in good condition, you can skip to #8 and begin the process of adjustment.

3. Disassemble the brakes.

- a. Unlock transverse cable from non-drive side cantilever arm by removing the ball end of the transverse cable from its mount (squeeze the brake arms together to give you cable slack to do this).
- b. Unlock drive side end of the transverse cable by unscrewing the anchor bolt and set transverse cable aside.
- c. Loosen and remove cantilever post bolts. These are the bolts around which the cantilever arm pivots. Remember, once these bolts are removed all the parts of the brake are loose and can fall on the floor. Please use caution. The parts you should now have taken off the bike are the cantilever post bolt, a washer, the cantilever arm, the spring, and the spring casing.



**3. Disassemble** the brakes (continued)

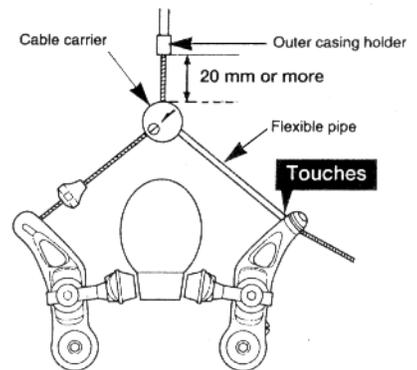
- d. If cables are frayed, rusted or broken, loosen and remove cable hanger. This is the small metal hanger that the transverse cable went through. Now, remove the cable housing and inspect it for rust or breakage.
- e. Remove the brake cable from the brake lever. Do this by looking underneath the brake lever and finding the ball-end of the brake cable. Align the “open” slot of both your barrel adjuster and barrel adjuster lock nut with the open end of the brake lever and remove the cable.

4. Clean and Inspect all the parts that have been removed.

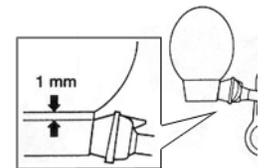
- a. Brake pads - Are they worn unevenly or worn too much?
- b. Cantilever arms, springs, and spring casing - rusty, bent/distorted or cracked?
- c. Cables and housing - Look for fraying, rust, and breakage.
- d. Brake lever - bent?

5. Replace Parts as necessary**6. Reassemble**- This is the same as disassembly only in reverse. If you are installing a new brake cable, tighten it enough so that the shoes are against the rim. Then squeeze the brake lever as hard as you can 10 times. The cable should stretch significantly. Then go ahead with the adjustment.**7. Adjust** the brakes. This process is the same for both front and rear brakes.

- a. Make sure that there is at least 20 mm of cable between the end of the cable housing (the housing stop or cable hanger) and the cable carrier (see diagram).
- b. Use the 4th hand tool to tighten the cable so that the brake pads are about 1-2 mm away from the rim when the barrel adjuster is screwed most of the way in. Then unscrew barrel adjuster six full turns.
- c. On the non-drive side cantilever arm loosen the bolt which holds the transverse cable and using a 4th Hand tool, tighten the cable until the brake pads are touching the rim firmly.
- d. Depending on how the brake pads are attached to the cantilever arm, loosen the pad slightly; enough that you can move it so the pad surface hits flat and centered on the rim.



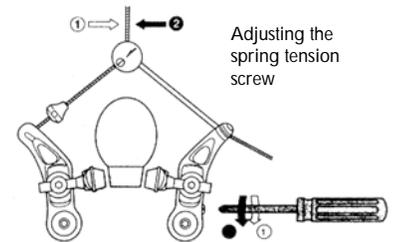
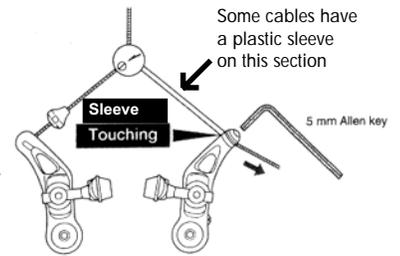
- e. Leaving the pad slightly loose add two to three millimeters of “toe” to each pad. This means that the front of pad should remain touching the rim evenly and you lift the rear of the pad slightly away from the rim so that when the brakes are adjusted the front of the brake pad will strike the rim first, thus eliminating a lot of vibration and squeaking. Once you’ve added the two or three millimeters of toe to each pad tighten down the pads as tight as you can, taking care not to let the pads rotate out of alignment in any of the three directions they could move.



- f. At this time the front ends of the pads should be touching the wheel hard enough so that the wheel can’t move and both pads should be toed properly. Make sure that your brake pads are tight enough by squeezing the brake lever and making sure that the pads don’t change their position.

**7. Adjust** the brakes (continued)

- g. Now screw the barrel adjuster back into the brake lever, thus loosening the tension of the brake cable and allowing the brake pads to fall away from the rim.
- h. Adjust cantilever spring tension. When you screw in the barrel adjuster and let the brake pads pull away from the rim, sometimes (most of the time) the cantilever arms will not pull evenly away from the rim. This means that the pads will not strike the rim at the same time, causing the wheel to eventually go out of true. Look at the brake pads and determine which one is closer to the rim and which is farther. If you increase the spring tension on the side which is closer to the rim, the pad will in turn pull farther away from the rim, centering the two pads on either side of the rim. Or, if you loosen the spring tension of the side that is farther away from the rim, it will pull closer in while the opposite side will pull further from the rim, achieving the same centering effect.



On many of the new cantilever brakes there are spring tension adjustment screws on the outside of the cantilever arms. If you screw in the adjustment screw it will push on the end of the spring coil, coiling it up tighter and adding tension to the spring, thereby pulling the cantilever arm and brake pad farther away from the rim. If you unscrew that adjuster screw the spring tension will be lessened and the cantilever arm and brake pad will fall in towards the rim. On other types of cantilever brakes there may be adjuster bolts that the spring threads into, and on some older types of brakes there is no spring adjustment at all. You may just have to bend the spring with your hand. Determine how to adjust your spring tension and do it so the brake pads are equidistant from the rim.

- i. Now squeeze the brake lever a few times to stretch the cable and feel whether or not the brakes are tight enough. To tighten the brakes unscrew the barrel adjuster until the brakes feel tight enough and lock down the barrel adjuster lock nut. If the brakes feel “mushy,” i.e. when you squeeze the brake lever there is a lot of give even when the pads are firmly touching the rim, you have not set the pads so that they are hitting the rim evenly and at the same time.
- i. Well, you’re done. Just remember, cantilever brakes are some of the hardest brakes to properly assemble and adjust. That means that it may take you more than once or twice or even five times to get the adjustment right. Don’t fret, you’ll get it eventually!!

**III. Language Skills**

Over the course of the lesson we should introduce all of these terms. At the end of the session it is often helpful to get the students to touch each of these parts on their bikes & say the name.

Main Part

Pads
Springs
Cantilever arms
Bosses/posts
Transverse cable

Main Part

Lever
Cable
Housing

Necessary Tools

Pliers
Box Wrenches
Allen Wrenches
Screw Drivers
4th hand

Other Materials

Grease
Oil
Locktight
Rags and aprons
Sand paper of file
Degreaser spray

Math Words

Parallel
Perpendicular
Friction
Leverage

IV. System Understanding Try different ways of phrasing this question.

What components are part of the Cantilever Brake System? How do they interact/affect each other/work together? How do they function as a whole?

V. Problem Solving/Diagnosis

1. What does it mean when your brakes aren't tight enough to stop you/too tight and your wheel won't turn?
2. How can you tell if you need an overhaul or just an adjustment?
3. If brakes become loose soon after you adjusted them what could that mean?
4. What other problem solving did we do?

VI. Review**VII. Clean Up**

VIII. Tool Check! Leave tool area as a group after confirming that all tools are present.