



## Sussing Out a New Grid The Brakes

Having a good pair of legs and a fast bike would be pointless without a reliable set of brakes. . . well, except for Track Cycling – one gear, no brakes. The shift towards Disc Brakes continues with some bike manufacturers not even producing any bikes with Caliper Rim Brakes – their catalogues are bereft of any Caliper Rim Brake bikes. We'll look at some of the advantages and disadvantages of the commonly available systems out there, so that you can make an informed choice when you go to buy your new bike.

### Caliper Rim Brakes

The earliest version (1800's) of this brake system was referred to as a **Spoon Brake or Duck Brake**. The system was designed to apply a metal pad or roller against the top of the solid tire. This worked okay with the solid tires of this time, but the Dunlop Tire Company came along and changed all that. Dunlop began producing the pneumatic bicycle tire. And that meant that the braking surface had to be transferred to the rim. Remarkably the design has not changed a great deal for over 200 years!

Cantilever and V-Brakes are variations of this mechanical brake system.

The old saying goes "If it ain't broke – don't fix it." So, what are the advantages and disadvantages of the Caliper Rim Brake and why did the disadvantages usher in the Disc Brake System?



### Advantages

1. Higher end groupos have honed their Caliper Rim Brakes to be very lightweight, while maintaining strength and safety.
2. Despite many reductions in disc brake system weight, Caliper Rim Brakes are still generally lighter.
3. Service of the system is relatively simple.
4. Braking noise is rare and easily corrected by toeing in the brake pads, replacing the brake pads, or deglazing the brake pads on a sandpaper block.



### Disadvantages

1. On extended descents, heat from braking can cause tire tube air pressure to increase to the point of blowing out one or both tires.
2. Water on the rims will reduce braking substantially.
3. Brake lever pressure required to stop a bicycle in an emergency may be beyond the abilities of smaller individuals, seniors, and riders with arthritic hands.
4. Contamination of the brakes pads by road grit dramatically increases rim wear.
5. Brake pads wear as do the rims. Brake pad replacement is quite inexpensive and easy to do. However, rim replacement can be quite expensive, and lacing new rims to the existing hubs isn't for the faint-of-heart. Often cyclists will opt for a completely new wheelset (see below).



- Although new wheels for rim brake bikes are quite plentiful currently, as more bikes come equipped with disc brakes the supply of rim brake wheelsets may become increasingly difficult to find.

### Disc Brakes

For some it may be a surprise to find out that Disc Brakes were invented in 1889 and patented in 1902. The Budd Company in the U.S. first introduced disc brakes on trains for the Burlington Railroad in 1938. Aircraft would see the system adopted near the end of the 1950's. Disc brakes first showed up in automobiles on the 1952 Jaguar C-Type.

The first bicycles to commonly come equipped with disc brakes was on the iconic Schwinn Stingray (right). However, disc brakes really began to show up on bikes after the year 2000.

It should come as no surprise disc brakes, both mechanical (cable actuated) and hydraulic (using either mineral oil or DOT designated (automotive) brake fluid) are showing up on most new bikes. They are attractive for recreational cyclists because of their stopping power and their higher performance in wet conditions.



### Advantages (Hydraulic)

- The disc is higher up away from most road splash, and their wet performance puts Caliper Rim Brakes in the shade.
- The design of the system sets unparalleled heat dissipation first and foremost. Discs are perforated, calipers and even the brake pads themselves (right) have fins to improve cooling.
- By employing the best of Pascal's Law, the fluid pressure developed, when the brake lever is applied, is felt throughout the brake system virtually undiminished. Force can be multiplied quite easily by altering piston and bore diameters of the brake lever and/or brake caliper during the design phase.
- Disc Brake linearity is excellent with good brake feel.
- Brake power is excellent and is virtually the same wet or dry, hot or cold.
- For smaller individuals, seniors, or those with arthritic hands the light lever action is a great advantage.
- The use of powerful disc brakes spurred on the development other bike components such as the Thru Axle (left) which stiffens and strengthens the front fork. Scissoring of the front fork was an issue early on when Quick Release Skewers could not prevent the fork blade with the brake caliper from walking back when the brake was applied.
- Since there aren't any brake calipers/pads for the tire and rim to fit through, greater tire widths can be accommodated and mud clearance is improved.



### Disadvantages (Hydraulic)

- Likely the biggest complaint from cyclists whose bikes are equipped with disc brakes is brake noise. Brake discs and brake pads can become glazed and/or contaminated and cause squealing. Very light sanding of both the brake pads and the discs, followed by flushing with Isopropyl Alcohol will often eliminate the noise . . . for the time being. We do not ride our bikes in laboratory clean rooms, so re-contamination is inevitable.
- The incredible braking power can come as a surprise for the uninitiated rider, resulting in skidding, loss of control and ultimately a trip over the handlebars – followed by a trip to the ER.
- Early hydraulic disc brakes had a bad habit of admitting air into the brake system, especially where ambient temperature extremes caused the various hydraulic parts to expand and contract at different rates. That has

mostly been eliminated in current brake systems. However, any amount of air in the hydraulic system can result in spongy feeling brakes and a considerable loss of braking power.

4. Service of hydraulic brake systems is complicated and should be left to the experienced bike technician.
5. Hydraulic brake lines can be severed, especially on Mountain Bikes, leaving the rider without either front or rear brakes. A failure of both front and rear brake circuits is almost impossible.
6. Disc Brake rub, where the disc is not centered in the brake caliper (commonly from improper wheel installation) or due to a warped brake disc can be annoying. Properly centering the wheel after insertion in the bike drop-outs often eliminates the former and brake discs can be gently bent back into true to solve the latter.
7. Brake rub, due to the caliper not allowing the brake pads to retract properly or where the centering of the brake calipers has been knocked out of adjustment is a job for a trained bike technician to tackle.
8. Burns (on hot discs) and severe laceration from brake discs is mostly a problem for bike racers, both amateur and professional, where multiple bike pileups can leave riders forced against/trapped against the hot disc.
9. Some touring companies refuse to allow cyclists with hydraulic brake systems to use their bike in tours where the remote nature of the route can make servicing problematic. Hydraulic equipped bikes are a headache for ride leaders and service mechanics.
10. Brake systems use either Automotive DOT rated brake fluid or Mineral Oil. **THE TWO FLUIDS ARE NOT INTERCHANGEABLE.** Internal rubber components are designed to be compatible with one or the other.

### Mechanical (Cable Actuated) Disc Brakes

Found mainly on children's bikes and on entry level adult bikes, where manufacturers try to meet a price point, these systems give many of the advantages of hydraulic disc brakes at a lower cost.

#### Advantages (Mechanical)

Many of the advantages of the hydraulic brake systems apply to cable actuated disc brakes except:

1. These systems are easier to service at home by the rider.
2. Brake failure due to hydraulic leaks is eliminated.
3. These systems are less expensive – bringing down new bike prices.
4. These systems may be the only alternative to hydraulic brakes, that are not allowed on some organized tours, (see point number 9) and higher braking force is still needed due to the extreme descents encountered.



#### Disadvantages (Mechanical)

Many of the disadvantages of hydraulic brake systems is mirrored by cable actuated brake systems. The additional problems include:

1. Spongy feeling brakes are common due to the stretchy nature of the cables – even after cables have been properly pre-stretched.
2. Cables are prone to corrosion inside of the cable housing, causing brake rub/drag.
3. Ultimate braking power is not as good as hydraulic brake systems.
4. Cables are prone to corrosion, causing brake rub.

In conclusion, the trend towards disc brakes on all varieties of bicycle has gained momentum even amongst the professional peloton (who were initially skeptical) and will become the stock in the future. Most cyclists, upon trying a disc brake equipped bike, fall in love them, and just put up with the relatively minor problems. Your next bike should have disc brakes for their power and safety in all conditions.