The Wheel
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Front wheel diagram

- Circlip
- Spoke
- Hub and brake drum assembly
- Bearing
- Dustcap
- Bearing
- Spindle
- Spoke
- Nipple
- Rim
- Ring
- Cam
- Spring
- Nut
- Nut
- Nut
- Plate
- Lever
- Spring
- Shoe
- Rivets
- Lining
- Shoe
Drum brake

Springs

Cam

Pads

Shoes

Drum brakes

🌟 Advantages
• Water-resistant
• Low-cost and maintenance

🌟 Disadvantages
• Less effective in high-heat/friction conditions (like braking when going downhill with a heavy load)
• Susceptible to brake fade over a period of time
First drum breaks premiered in 1900 with asbestos lining.

Mid-1930s — fluid-filled cylinder with pistons began to replace cam (though our bike still uses the purely mechanical lever/cam system).

1960s and ’70s — disc brakes began to replace drum brakes.

Drum brakes are still common as part of a front-disc/rear-drum brake configuration.
Drum brake with cylinder and pistons
Truing the wheel: Process

- Start by assembling the hub (brakes, bearings, plate, etc.) and mounting the wheel on a truing stand.

- The wheel can be laterally and/or concentrically untrue. Both our wheels were concentrically true, so they only needed lateral adjustment.

- Tightening right-side spokes shifts (that portion of) the rim to the right, allowing for minute corrections of lateral wobbles.
Truing the wheel: Difficulties

- Warps and dents in the rim cause wobbling that can’t be corrected by spoke adjustment.
- The rim of the rear wheel is more susceptible to damage than the front.
- Stripped spokes cannot be tightened and must be replaced.
Exercise: a single spoke

- Imagine entire weight of motorcycle is supported by one steel spoke. What is the minimum diameter of the spoke if the breaking point of steel is 100,000 psi?

- 200 lbs. bike + 200 lbs. rider = 400 lbs. of downward force total, or 200 lbs. per axle

- \[ \sigma = \frac{F}{A} \]

- \[ 100,000 = \frac{200}{A} \]

- \[ A = 0.002 \text{ in}^2 \]
Introducing a safety factor of 2 would halve the breaking point of steel, so new $\sigma = 50,000$ psi.

$50,000 = 200/A$

$A = 0.004$ in² (i.e. double what it was originally)

Minimum spoke diameter = 0.03568 inches
On our motorcycle

- Spoke diameter varied between 0.104 inches and 0.130 inches (newer spokes were thicker)

- For the thinnest spoke:
  - $A = \pi r^2 = 0.0085 \text{ in}^2$
  - So the area of the spoke face was more than double the minimum, even with a safety factor of 2.
Sources

- http://www.slowtwitch.com/Tech/Wheel_Truing_How-To_3503.html
- http://s.hswstatic.com/gif/drum-brake4.jpg