

There was a time when unicrown forks were state-of-the-art. However, as mountain bike technology has expanded so has the choice of available forks. In the last two years the most sensational off-road design debate centered around straight versus curved-blade forks. This was almost a moot argument from the very beginning and accordingly there was no real victor—as a marketing scheme the debate fizzled when consumers failed to respond unanimously one way or the other. Ovalized fork blades, oversize blades and non-tapered blades were other areas of great hoopla and fanfare. Up until this year the major fork wars were fought using the same artillery, the Uni-

crown fork. Much as nuclear weaponry redefined the way in which modern wars are fought, a new weapon has been introduced into the fork battle which could forever alter the front end of your mountain bike.

Since 1985 Keith Bontrager has been producing his version of the ultimate fork. Keith's design emanates from his years of experience in the world of motorcycle suspension. Wheel clearance and lateral and torsional strength are brought to new levels

*Have Unicrown forks
become outdated?*

GUIDE TO

RADICAL FORKS

with Bontrager's design, which uses chromoly fork blades that are bolted into an aluminum fork crown.

WHAT'S THE BIG DIFFERENCE?

Though heavier than the standard Unicrown, Bontrager's design offers a list of good points that many believe override the weight disadvantage. A Unicrown fork requires welding the chromoly blades to the steerer tube. The intense heat from this process can diminish the chromoly's original strength by approximately 30 percent at the spot where the forks are prone to bend most. Bolting the forks together, as Bontrager does, instead of welding them allows the chromoly blades to retain all their strength. Best of all



BONTRAGER STANDARD COMPOSITE

PRICE: \$195

WEIGHT: 2 lbs., 2 oz.

WHEEL CLEARANCE: Top: 1"; side: 9/16".

MATERIAL: True Temper 4130 chromoly blades, 6061 aluminum crown.

NOTES: These are Bontrager's original fork. All the parts are replaceable. Two different fork blades, regular and heavy-duty, are available to fine-tune the ride. The standard fork is intended for heavier and/or more aggressive riders. Both one-inch and 1-1/8-inch steerer tubes are available for both Bontrager forks.



BONTRAGER BONDED COMPOSITE

PRICE: \$215

WEIGHT: 1 lb., 15 oz.

WHEEL CLEARANCE: Top: 1"; side: 9/16".

MATERIAL: True Temper custom 4130 chromoly blades, 6061 aluminum crown.

NOTES: This is Bontrager's racing fork and it is not as indestructible as his standard design. They weigh approximately 15 percent less than the standard fork. The tapered blades run from 1-1/8-inch at the top to 0.35" below the brake boss. They use a machined alloy dropout and both the dropout and the brake bosses are glued on. Black and silver anodized crowns are available.



BRODIE GATOR BLADE

PRICE: \$250

WEIGHT: 2 lb., 7.5 oz.

WHEEL CLEARANCE: Top: 1"; side: 3/8".

MATERIAL: Machined 6061 T-6 aluminum crown, Tange 4130 chromoly tapered blade.

NOTES: The Gator Blades are hand-built by top Canadian bike builder Paul Brodie. There is a solid aluminum insert in the fork blade for increased reinforcement. The bolt goes through the blade and into the reinforcing sleeve of the steerer tube. Custom paint is available. The forks have a 1-3/4-inch offset and are only available with a one-inch steerer.

is that all of the parts of the Bontrager are replaceable, which makes repairs much simpler and more economical.

The Bontrager forks are also available with blades of varying degrees of stiffness. This allows a rider to custom-tune the strength and absorption capabilities of his front end. As with any popularly accepted rage in the marketplace, there has been a variety of imitations. Manitou, Brodie, Tange, IBD and others have all come up with their own interpretation of the Bontrager design. Visually similar, each of these other forks has unique attributes. Tange is the only one who has worked with Keith in developing their fork.

Lacking suspension, mountain bikes rely on their front forks more than any other part to maintain control and high-speed stability. They also take the brunt of most trail impacts. These new-generation forks offer strength and precise steering, not to mention their biggest attribute—increased wheel clearance. One drawback, however, is that as the forks get wider and the rims are getting narrower, the relationship between stan-



Making the transition: Mountain bike forks aren't at all what they used to be. Myer's Greg Herbold tested the new Rock Shox suspension forks at last year's World Championship cross-country and downhill events with good results. Though the only one using traditional suspension, Rock Shox are just one of many new and radical designs available. Herbold will use the forks for the duration of this year as well.

dard-size components can become strained. Braking can be problematic when combining wide forks with narrow rims. Some of these fork builders are taking this into consideration by repositioning the brake bosses to a more inboard position. Be sure to consult your dealer or the fork manufacturer about the proper setup for your bike.

THE SUSPENSION EQUATION

Of course, it was only a matter of time before someone applied suspension technology to a mountain bike front end. Various designs have been tried, but without a doubt Rock Shox, designed by Paul Turner and manufactured by Dia-Compe, is on the cutting edge of suspension development. The Rock Shox were introduced last year (MBA, May '89) and improvements have already been made on the oil-damped, air-sprung suspension units to make them more durable. Weighing in at 3 lbs. 2.5 oz., the Shox provide two inches of travel. The MBA winning crew felt that the added weight was a trade-off for decreased bump-induced fatigue. We just enjoyed the smoother ride!



FUNK BIG FORK

PRICE: \$179

WEIGHT: 1 lb., 9 oz.

WHEEL CLEARANCE: Top: 1-1/16"; side: 1-1/8"

MATERIAL: Titanium steer, TIG-welded 6061 T-6 aluminum blades with 7075 T652 aluminum dropout.

NOTES: Fork forks are available with either a standard one-inch or oversized 1-3/4-inch steer. The dropouts are aerobically bonded into the 1-1/2-inch outside diameter forks with 1-7/8-inch offset. Available separately or as standard equipment on Funk mountain bikes.



IBD ALUMINUM

PRICE: \$235

WEIGHT: 2 lb., 2.5 oz. (without cantilever bosses)

WHEEL CLEARANCE: Top: 1-5/8"; side: 1"

MATERIAL: Aircraft-grade aluminum crown, mill spec 2000 series aircraft-grade aluminum blades.

NOTES: Tapered single-butt blades are pressed onto an aluminum dropout. IBD forks are unique due to the suspension quality derived from the configuration of the slot cut into the crown, which allows the crown to flex. The blades are mounted on five-inch centers and the fine and aft movement creates no loss in radial rigidity. The forks accept either cantilever or IBD Rotary brakes.



IBD TITANIUM

PRICE: \$300

WEIGHT: 2 lb.

WHEEL CLEARANCE: Top: 1-7/8"; side: 1"

MATERIAL: Aircraft-grade aluminum crown, 3.2 mill spec titanium blades.

NOTES: The straight-gauge titanium blades share the 1.5-inch offset with the aluminum fork. Both forks are available with either a standard one-inch or oversized 1-1/8-inch steer. The blades are replaceable and the complete units are fabricated in Oregon.

Like Bontrager, Paul Turner had an extensive background in motorcycle suspension before turning his attention to mountain bikes. Turner's design for the Rock Shox evolved from the fork first seen on the radical Keirrel Nitro. That fork, as well as early Rock Shox units, enjoyed the design input of Keith Bontrager as well. Eventually Keith bowed out of the Rock Shox project, although it is his aluminum fork crown that is used (Bontrager and Rock Shox fork crowns are not interchangeable). Unlike many other suspension systems, there is no manual lockout with the Rock Shox. Turner's sophisticated oil-dampened design makes a manual lockout unnecessary.

The forks do not absorb the rider's pedal energy. Suspension proponents favor the system for the reduction in both body and frame stress. Suspension also allows lower tire pressures to be run without flatting.

For those who think the heavier Rock Shox have no application in racing, Paul Turner proudly points to Sara Ballantyne's domination of the European World Championships last year using the forks. For 1990

the rider list includes top pro Tom Collins, Susan DeMattei and probably the most radical mountain biker in the world, Miyata's Greg Herbold.

NO FUNERAL JUST YET

Is the Unicrown dead? Certainly not to the large bicycle companies that like their lower cost and ease of manufacture. Try as they might, none of the radical new forks (except the Funk, which doesn't use a bolt-together fork crown like the rest) can get close to a Unicrown in the weight department. Unicrown development too has forged ahead. Companies like Specialized, Ritchey and Yeti have put a lot of work into designing a high-performance Unicrown, and no longer are they the spindly one-inch legs of the past. In the next issue of *MTB* we'll take a look at the cream of the crop of Unicrown forks to see how they compare.

For this feature the wrecking crew searched all across America and into Canada to find the most radical non-Unicrown forks available. From the exotic oversized aluminum fork from Funk Bicycles to the rigid-looking suspension forks from IRD, we collected the top names in alternative fork designs. If you can't find anything radical enough for your tastes here, you're out of luck!

THE MAN SPEAKS FOR HIMSELF KEITH BONTRAGER

• Creating a good off-road bicycle design requires some departure from traditional construction techniques. Almost all of the successful, non-trivial innovations in off-road cycling have this one design element as a distinguishing feature. Over the past five years or so the good designs and the bad designs have been sorted out—the good designs survive, the bad designs die away. The differences are that the good designs work, they do something for you, while the bad designs just cost you money. I concentrate on making good designs, designs that solve real problems that limit a cyclist's performance.

BEHIND THE BONTRAGER FORK

Our fork is built from 4130 steel and high-strength aluminum alloy. The use of two types of metal is called composite construction. This is not the same as advanced composite construction, which involves the use of carbon fiber materials. The forks have been in development for over five years and we have a patent pending on the principal design elements. Our intention was to make



KONA TRAK TWO

PRICE: \$175

WEIGHT: 2 lb., 4.5 oz.

WHEEL CLEARANCE: Top: 7/8"; side: 1/2"

MATERIAL: T-6 6061 Reynolds aluminum crown, Ishiwata tapered chromoly blades.

NOTES: The Trak-Two was designed by two-time NORBA National Champion Joe Murray. The aluminum crown is acquired in America and sent to the Spinner factory in Taiwan for construction. The forks use an investment cast dropout. Black chrome blades are matched with a polished crown. The forks have 1-3/4-inch offset and are only available with a standard one-inch steerer tube.



MANITOU MOUNTAIN FORK

PRICE: \$195

WEIGHT: 2 lb., 4.5 oz.

WHEEL CLEARANCE: Top: 7/8"; side: 1/2"

MATERIAL: Machined 6061 T-6 aluminum crown, 1-1/8-inch 4130 chromoly blades.

NOTES: Manitou forks stand out with their polished, gullwing-design crown. The 1-1/8-inch straight taper blades have a .035" wall thickness and are replaceable. Cantilever or roller cam brake mounts are available. The forks have 1-3/4 inches offset and are finished with metallic silver Imron paint.



ROCK SHOX

PRICE: \$360

WEIGHT: 3 lb., 2.5 oz.

WHEEL CLEARANCE: Top: 7/8"; side: 5/8"

MATERIAL: Machined 6061 T-6 aluminum crown, 4130 chromoly upper tubes and steerer, 2000 series aluminum bottom from billet.

NOTES: The Rock Shox offer two inches of wheel travel. An inflation gauge is included in the price. Rock Shox are available with any size steerer. Fork offset for one-inch steerers is either 1.6 inches or 1.8 inches; oversize systems have a 1-1/8-inch offset. Cantilever mounts only. Rock Shox will be offering a cash contingency program for Pro riders in NORBA National cross-country, dual-slam and downhill events.

a practical and affordable fork for riders who bend Uncrown forks or desire a versatile, adjustable fork. Because of the composite design, our forks offer unique ride characteristics and incomparable strength-to-weight ratios.

With the Bontrager design the blades and steerer are changed together by an aluminum crown. If you want to change the fork blades because they are damaged or you want to change the geometry, the bolts that hold the fork together can be loosened and then the blades removed or replaced. The strength benefits of this type of construction are significant. It's true that there is no way to produce a beared, non-heat-treated Uncrown fork that is as strong as our fork without increasing the weight by 30 percent or so.

THE TECHNICAL SIDE

It is surprising to see how many mountain bike riders bend their Uncrown forks. The forks are bent in either of two directions: forward from the impact of landing after a jump, or backward from a head-on impact. Stronger forks are a necessity for this type of rider, but if the fork is made too strong the frame will fail instead of the fork and this is an expensive solution.

Stock frames seem to survive jumping impacts fairly well, so increasing the strength of the fork does not seem to put the frame at risk when the loads that bend the forks are from jumping. However, stock frames do not survive large head-on impact loads well. The impact will frequently cause the down tube to bend where it attaches to the head tube. The only way to increase the strength of the bicycle (frame and fork) is to reinforce the frame and to install a stronger fork. I am not aware of a stock frame other than some aluminum frames that are well reinforced, but a competent builder can reinforce a frame that isn't damaged. Standard lugs do not reinforce the joint well enough. Prestige tubing does not increase the strength of the frame at the joints after they have been brazed. The combination of a reinforced frame (of any material) and a composite fork is close to the optimum for current materials.

A QUESTION OF HEAT

High-quality 4130 chromoly tubing is strengthened by cold working while it is drawn. This results in an increase in the yield strength of the tubing. This strengthening mechanism is lost when the tube is heated to brazing or TIG-welding temperatures.

The actual process that occurs during the softening of the tube in the heat-affected zone depends on the type of brazing temperature used, but differences in the final tube strength due to the various brazing processes are small. In all cases the tube is weakest near the brazed or welded joint where it has lost the strength of the cold working process. The difference between the as-delivered strength of the tubing, about 100 kpsi, to the final strength, about 70 kpsi, is on the order of 30 percent. This is a substantial decrease in strength.

The structural problems of a brazed or TIG-welded unwelded bicycle frame joint, whether it is that of a fork or a frame, are due to the effects of the brazing operation on the steel tubing and the steers at those joints. The softening of the heat-affected zone is inevitable and it occurs independently of who is holding the torch, what material they are brazing with or what strengthening process the tubing has gone through prior to the brazing/welding operation. The thicker wall does not add enough strength to avoid failing there.

A Uncrown fork is weakened in the blades and steerer near the junction of these three tubes where the bending loads are highest. There is little difference in the strength of the assembly when a crown is used or when the weld size is varied. In fact, a large heat-affected zone may actually weaken the blades because it cools more slowly than a smaller weld zone. Ovalizing the blades up to the bend at the crown area does not increase the strength of the blade in the area affected by the welding, either. Large-diameter blades are stronger, but the steerer is still weak and the blades are heavy. I've seen plenty of these fail so far. Simply adding metal is also not the best solution to the problem. The new forks with a larger diameter at the dropout will cause the fork to have a stiffer ride and will not increase the strength of the fork. *



SYNCHROS POWERLITE COMPOSITE.
PRICE: \$165

WEIGHT: 2 lbs., 2 oz.

WHEEL CLEARANCE: Top: 1 1/2" side: 7/8"

MATERIAL: Tange chromoly steerer tube, 6000 series 6061 T-6 aluminum crown from billet, custom-drawn 4130 heat-treated chromoly blades.

NOTES: Dropouts are machined 6061 T-6 aluminum. The one-inch straight-gauge blades are available with either a 1-5/8-inch or 1-3/4-inch offset. Standard one-inch and 1-1/8-inch steers. Replaceable blades with an epoxy powder coat gloss black finish. The crown uses a Camloc design which eliminates blade creep.



TANGE SWITCHBLADES.
PRICE: \$150

WEIGHT: 2 lbs., 5.5 oz.

WHEEL CLEARANCE: Top: 1 1/2" side: 7/8"

MATERIAL: Tange seamless chromoly tapered blades, heat-treated T-6 aluminum crown.

NOTES: The Tange switchblade is assembled in America. Replacement blades are available and Bontrager Blades are interchangeable. In March a new Switchblade will be available featuring a reprofiled, anodized crown, increased blade diameter and 100g lighter. Forks with either a standard one-inch or 1-1/8-inch steerer tube are available.

CHOOSE YOUR WEAPON WHO TO CONTACT

* **BONTRAGER BICYCLES**, 342 Mariner Blvd., Santa Cruz, CA 95062-1400; 402-0270.
INTERLOC RACING DESIGNS, P.O. Box 475, Selma, OR 97136; (503) 597-4241.

FUNK BICYCLES, 7815 W. 4th Ave., Unit D, Lakewood, CO 80224; (303) 223-3096.

THE BICYCLE GROUP (Oak Two and Bottle Capor Forks), 3122 Fir St., Blaine, WA 98203; (206) 332-5554.

MANTOU MOUNTAIN BIKES, 4160 Canyon Rd., Colorado Springs, CO 80906; (719) 434-9607.

TANGE USA, 4047 E. Thousand Oaks Blvd., #215, Woodlake Village, CA 91362; (818) 773-4270.

ROCK SHOX, Case Creek Rd., P.O. Box 798, Fletcher, NC 28732; (800) 677-7577, (704) 484-3334.

SYNCHROS, P.O. Box 2019, Bellingham, WA 98227; (360) 879-6686. □