CUNNINGHAM™ OFFROAD BIKE INFOPAC

1989 EDITION

"It is easy to build a light bike. It is also easy to build a strong, durable bike that is not so light."

"The real challenge is to combine the right level of light weight, strength and durability to produce the best possible overall function. This is the true test of materials understanding, engineering knowhow, experience, and intuition."

CHARLIE CUNNINGHAM
CUNNINGHAM APPLIED TECHNOLOGY

INCLUDES BIKES BY CUNNINGHAM, COMPONENTS BY WILDERNESS TRAIL BIKES, OPTIONS, DRAWINGS AND PRICE LIST.

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$5.00

INTRODUCTION

I built the first heattreated, large tube aluminum mountain bikes in 1978. Few people today today realize that the technology in my early bikes was not readily accepted. The first aluminum Cunningham provoked disbelief, and the lack of a paint job was "just too much" for most people. The bike had geometry that was considered radical, and weighed only 24 1/2 lbs. It sported an unheard of sloping top-tube, 136 mm rear drop-out spacing with a zero dish rear wheel, an extra wide 115 mm. front hub, Type II forks, a large diameter seattube and post, an 87 mm bottom bracket shell with sealed cartridge bearings, toe clips, toeflips and a one piece, machined magnesium stem. At a time when only drum brakes and cantilevers were to be found, it had powerful handbuilt toggle brakes. The brakes were mounted on special high strength studs which later became the model for today's cam and U-brake mountings.

The ideas were little understood in those days and often met resistance. After ten years of patient work, most of these early design concepts have become standard in the off-road bike industry, the fastest-growing segment of the bike market. My persistence in refining aluminum mountain bike technology and educating people to its merits, helped prepare the market for the Cannondales, Kleins, American Breezers and others which have followed. In contrast to when I began, today's manufacturers and enthusiasts are characterized by a willingness to try anything, even the far-fetched, so long as it is the lastest and coolest. Amidst all the noise and drama, the mountain bike continues to improve, and brighten more lives.

My inspiration continues to be fired by riding a finely crafted, intelligently engineered bicycle in the rough wilderness terrain it is designed for. My enthusiasm for high-performance off-road rid ing, and the wish to make it available to others is why I choose to build to the highest standards and make only a few.

Although there have been various opportunites to produce a less expensive, more widely available production version of the Cunningham, I have declined. By increasing quantity, one inevitably must make compromises, and lose some control over the end result. I value the fact that at my small scale, I can rapidly incorporate improvements into the bikes I build for others. I stand behind each bike 100%. It's good to know that all my bikes have found good homes.

WHAT HAPPENED IN 1988?

A pause from building bikes in 1988 was needed in order to devote time to component and tire design and testing, as well as to Wilderness Trail Bikes which is at a critical stage of growth.

Jacquie and I were abducted into the Mountain Bike Hall Of Fame. Plus, we got married. These things take time.

I plan to build ten bicycles in 1989. The focus this year wil be to make the finest, most evolved bicycles yet. A number of refinements will be available as options on new bikes, and as "updates" for existing bikes.

CUNNINGHAM APPLIED TECHNOLOGY

Cunningham bicycles grow on giant baobab trees cultivated here at Cunningham Applied Tech! Actually, much as I would like such a set up, they are still being designed and made by me at my shop. The forks and most of the other components are also developed and built here or at WTB. I ride every day, as do the Cunningham Team racers, so the workings of the bikes are always being evaluated and new ideas tested. The result is that the latest offroad technology is available to Cunningham owners before it is adopted by the industry and becomes widely available. Likewise, the format of this information packet is chosen in preference to a glossy brochure so I can update it and keep you informed on the latest equipment.The INFOPAC is organized so you can read the whole thing or just the subject you are interested in.

After reading the Infopac and deciding what you want, an order is usually placed at one of the shops that sell the bikes. I like to be available to answer questions and to get to know the people that buy my bikes but there is so much work to be done that I need to limit the amount of time I spend talking. I would like to hear from you if you are buying a bike and definitely want to help take care of any problems or questions that the shop can't handle.

My bikes are on display at the following locations where they can be test ridden and purchased or orders placed. They can send photos of the type of bike you are interested in if you are unable to see them at these shops. Complete bikes usually range in price from $1950 to $4750 depending on options and component choices.

Point Reyes Bikes, 11431 Hwy. One, Box 362 Point Reyes,CA 94956,(415) 663-1768)
(800) 682-4537 USA , (800) 245-3777 CA
Michael Castelli

Mountain Avenue, 1269 9th Ave., San Francisco 94122 (415) 665-1394 Gene Maruszewski

Rim Cyclery, 94 West 1st North, Moab, UT 84532,(801) 259-5333 Bill Groff

WILDERNESS BIKES TRAIL

In 1982 Steve Potts, Mark Slate and I combined our talents and resources in a company we called Wilderness Trail Bikes. WTB was originally created to insure availablity of the finest American made offroad equipment for the bicycles we build. The company has grown in scope to include the manufacture of this equipment for other offroad enthusiasts, and even the licensing of our designs to other leading manufacturers. Some examples are the Specialized line of offroad tires, the geometry and specifications for the 1987 TREK Mountain Bike line, and the Suntour version of the Roller Cam Brake. WTB components and literature can be ordered by calling (415) 924 -9632 or writing us at 134 Redwood Ave., Corte Madera, CA 94925.

ALUMINUM FRAMES, MYTHS, PAINT, AND THE ZEN OF BICYCLE TECHNOLOGY

To eliminate misconceptions and help people understand welded, oversize aluminum as a frame material, I offer the following information to help you determine if a Cunningham is the right bike for you.

As an avid wilderness rider, I was attracted to the welded aluminum frame by its performance and efficiency. There are few experiences that compare to riding one of these finely-tuned, high efficiency machines in the rough terrain they are designed for.

Aluminum Bikes Are All The Rage

As the advantages of welded oversize aluminum become more widely recognized, other manufacturers are beginning to offer such bikes. Although welded and heat treated aluminum tube structures are not new, the application to offroad bike frames is relatively new and my own experience indicates that there are many

subtleties that the builder must be aware of to work successfully with this material. Companies hastening to make aluminum mountain bikes available sometimes take shortcuts and risk making mistakes from lack of experience and adequate testing.

As example, some welded aluminum bike makers are using grades of aluminum in their frames that do not need heattreating to help reduce cost. Unfortunately these alloys have a shorter life expectancy. How many of the owners of these bikes will know the difference if their frame breaks? This kind of situation can cloud the reputation of aluminum as a frame material.

It is my conviction that aluminum, if properly engineered, will prove in time to be widely accepted as the ideal material for high performance bike frames. Every person that acquires a Cunningham bicycle can help support my effort to insure that aluminum gains an impeccable reputation as a frame material by providing me with information gleaned from the use of their bikes under all conditions.

How Aluminmum Compares To Steel

A 21" Cunningham frame is 2.5 to 4 lbs lighter than a top quality 21" lugless chromoly frame and is more than twice as strong in a frontal impact. (See Aug 83 Biketech for test results. Light, brazed steel frames bend comparatively easily at the headtube joints because of the annealing effect the slow cooling joint has on the nearby steel.) The Cunningham frameset is lighter, stronger and more energy efficient than a well designed chromoly frameset. The large aluminum tubes give a further benefit; a bottom bracket which is exceptionally flex resistant. This means that more of your energy goes into moving the bike forward, instead of becoming lost motion. For anyone that does a lot of riding these attributes are impressive.

How Aluminum Compares To Titanium

Titanium is a hot item in today's bike market. The word conjures up images of exotic aircraft, medical equipment and now expensive bike frames. I like the alloys of titanium. Some of their properties are very desirable. They have good abrasion and corrosion resistance and are good at retaining their shape once formed. I have been using titanium alloys for many years in some of the custom parts I build. I would be making frames out of titanium if I thought it was better for the job than aluminum. Here's why I prefer to use aluminum in my bike frames:

1) Suprisingly, the stiffness to density ratio of aluminum, titanium and steel are virtually the same. This means that they offer the same degree of stiffness for equal weights of metal. The lower density of aluminum (2.7 g/cc) gives it a structural performance advantage over titanium (4.5 g/cc) in the same way both metals have an advantage over steel (7.8 g/cc). *The lower density of aluminum permits more volume of metal to be used at any given weight*. This means that the aluminum tubes can be larger in cross-section than those of titanium without having them be too thin. At any given weight level, this translates to greater strength and stiffness. This low-density property of aluminum can be used to great advantage by a skillful, experienced builder to tailor the level of strength, stiffness, and fatigue resistance for an optimal balance of each quality throughout the frame, including better overall frame life. A typical 21" Cunningham mountain bike frame weighs 3.5 lbs. Competition versions are about 3 lbs. They have proven to have extraordingary life expectancy. After eight years of Pro Am offroad racing Cunningham bicycles have a reputation for setting the highest standard as the lightest, most durable bikes obtainable.

2)Titanium is particularly susceptible to localized, weld-induced thermal and restraint stresses which can cause early cracking.

3)When welded, titanium has a strong tendency to absorb hydrogen and other impurities which weaken and embrittle it. This can be overcome with extremely diligent control of the welding environment, but it is difficult to control, and probably isn't done on a consistent basis by most builders. The methods used to control the welding environment prevent desirable pre-heating of the weld zone, which helps reduce heat distortion and consequent misalignment in the finished frame. A misaligned frame will have to be straightened by cold-setting (bending), which can induce stresses within the frame. More importantly, there are some types of misalignment caused by heat distortion during welding that can't even be removed from the finished frame. Thus, most titanium frames are probably not perfectly aligned.

In contrast, with aluminum, the normal TIG welding process is sufficient for protection from contamination because it does not tend to absorb gasses and any impurities tend to float conveniently to the surface of the metal. There they form a thin coating which doesn't affect the integrity of the metal. The film of impurities is easily cleaned off later. Repairs on aluminum frames are much easier. I have re-welded damaged parts of a frame without even taking the bike apart. Proper titanium repairs require that the insides of the tubes be thoroughly protected by inert gas during welding which becomes more involved.

Because aluminum can be easily preheated prior to welding, distortion is greatly reduced. After welding, the aluminum frame is heattreated. In one of the heattreating stages, the aluminum frame becomes "butter soft", so it can easily be aligned to perfection. The final hardening stage (artificial aging) is accomplished by holding the frame at uniform low heat for many hours, with slow cooling. This results in a frame that is extraordinarily strong and straight. It is able to spring back to its original shape without change when large loads are applied ... exactly what is needed in a mountain bike frame.

4) The natural size of the titanium weld bead is quite small, similar to that of TIG welded steel. This creates sharp corners and high stresses where tubes join at 90-degrees or less and can result in early cracking. The aluminum weld bead is much larger and can be shaped by a knowlegable builder to greatly reduce stress concentrations at the joints. As a result, a well-built aluminum frame can outlast titanium frames.

5) Optimal alloys,tube sizes, and wall-thicknesses have not been available in titanium, so builders are forced to use tubing that is less than ideal. Most titanium frames I have seen are quite flexible, which compromises efficiency, handling and brake mounting stiffness. Tubing availability may improve in time, if there is enough demand by titanium builders for proper tube sizes.

All this might sound like I am tring to discredit titanium, but I'm not. It is an excellent metal which I use frequently, and it can make fine, serviceable frames in the hands of a conscientious builder. But I definitely prefer aluminum for my bike frames.

Aluminum's Limitations

While large diameter aluminum frames excel structurally, they are in theory slightly more susceptible to denting than a comparable steel frame. In practice however, denting has been quite rare in the nearly 150 frames I've built. This could be because some of the tubes in a Cunningham are harder to dent than their steel counterparts due to their greater thickness.

Aluminum also scratches more easily. Special care is needed when transporting aluminum bikes with steel bikes next to them to prevent steel from vibrating against the aluminum which can mar the frame.

The equipment and skills necessary to work on aluminum frames are fairly rare and any modification, repairs or further work should be done by the manufacturer. This is usually the case with any custom frame, but it is especially true with aluminum frames. For this reason, I place a high priority on prompt response to your needs. I am usually able to do work and ship it out within a day or two of receipt. (The headset, bottombracket bearings, seatpost and other components are standard and can be replaced in any well equipped shop.)

The 6061 alloy which I use forms a passive oxide which protects the tubes from corrosion in the outdoor environment. The exception is constant contact with salty air or water. If the bike is to be used under these conditions I suggest that the frame be lightly oiled often with a spray lubricant like Starrett M1 or have it painted.

Aluminum Myths

"Oversize" aluminum tube bicycles seem to inspire either strong enthusiasm or stubborn skepticism in people. Occasionally heard comments from the Myth Department are: "They probably won't last." and "They must give a hard ride because the frames are so stiff." I would like to comment:

First, the experience I have gained working with aluminum frames for eleven years, combined with excellent engineering, results in a frame that has shown itself to last at least as long as the finest steel frames, probably much longer. The frameset is guaranteed to the original owner. I will replace or repair one time without cost any frame or fork that fails due to defective materials or workmanship during normal use. (It is noteworthy that during the many years of production none of my frames or forks have needed replacement as a result of normal use.)

Secondly, as for ride quality, my experience indicates that it is not the frame material that produces a hard or soft ride in a mountain bike. What is important is how the material is applied. For instance, steel frames can be built to be absurdly flexible or stiff. So can aluminum frames. Most mountain bike frames, regardless of whether they are made of oversize aluminum or some other material,do not flex enough in the vertical plane to absorb appreciable road shock. Frames are not effective springs in the vertical direction because of the triangulated shape. An overly flexible frame can however twist and flex from side to side, but this doesn't help absorb road shock, it only wastes precious energy and detracts from controlability. Some people claim that aluminum absorbs vibration better than steel which seems to be true, but it has been my experience that it is the forks, the tires, and frame geometry in particular that affect ride quality far more than the type of metal used in the frame. This is why I offer several forks with different ride characteristics and also different frame geometries... so I can build the bike to match your individual needs.

Another interesting aluminum frame myth I occasionally hear is that when an aluminum frame breaks, it snaps in half and the hapless rider eats dirt! While this is possibly true with the more brittle alloys used in glued and lugged frames, it simply is not the case with the alloy I use. When I began building frames many years ago I made some outrageously thin frames and didn't heattreat them to see how they would fail. After almost two years of pounding they began to creak around the headtube and an obvious crack grew for a week or so of use before the test was called off. I've learned over the years that failures from impact and fatigue are very rare in well built aluminum frames and do not result in catastrophic self destruction as some people would have us believe. Cunningham frames are quite springy and forgiving as tests (and horrors!...crashes) have shown. About the only way to bend one of these frames is to run over it with a truck. And they will bend, not break.

How To Find The Best Bike For You

If you really are looking for the best mountain bike, you shouldn't make your choice entirely on what sellers or builders, including myself, tell you. I give you my first hand knowledge, but you owe it to yourself to ride the bikes you are considering and experience the differences first hand. There is so much hype and confusion created in a competitive marketplace about what is good and what isn't that the only way is to see and think for yourself. Give the bikes the last word with a test ride. Talk to

people that own bikes like those you are interested in. How long have they been around and for how many years has the basic design been evolved and perfected? (A truly integrated machine dosen't happen over night.) How do they work? Do they last? How is service? Is the builder trying to build profits or fine bikes? The motive will ultimately be reflected in the bike.

With the wide range of option and component choices your Cunningham can be tuned to complement your own riding style. These bikes are the culmination of many years of riding and engineering experience and I believe them to be the best bikes available anywhere for competition, sport riding or touring.

To Paint Or Not To Paint

Last, I would like to consider beauty and aesthetics. My bikes reflect different values than those common in the bike industry. As builder and offroad rider, I'm drawn to that which makes the bike work better. I consider cosmetics and "flash" of lower importance. Some people expect a beautiful, thrilling paint job with a bike of this cost. Such thinking is partly from the racing 10-speed world where flash is definitely "in" and the bikes are so similar that the paint job takes on special significance.

Steel frames need paint to protect them. My frames don't need paint to protect them and the polished aluminum frame gives one freedom from having to worry about the paint job. Out in the real dirt is where that beautiful paint job that was so attractive on the showroom floor loses its thunder. This is where you discover what you have really got and where a Cunningham won't let you down. Personally, I prefer not to add something to the bike that it doesn't need. I want a bike that is trouble free, totally reliable and fun to ride and I don't need paint on my bike to accomplish this. I do offer Imron colors as an option and don't object at all to someone ordering their frame painted.

When someone asks, "Hey, how come you can see the welds?", I try to explain that there is beauty in efficient, functional design and that fine weld beads are beautiful to those who can appreciate them. Why try to hide them?

I offer this explanation to help people understand my bikes, not as an apology or a judgment on other peoples values.

FORKS

So you thought a fork was just a fork....

Fork requirements for mountain bikes are much different than for road bikes. The narrow high pressure tires on road bikes can't absorb much shock, so a fairly flexible fork is needed to contribute to shock absorbtion. On mountain bikes, the large tires are the primary source of suspension because of their much greater compressibility. The "New Generation Tires", such as the Ground Control , are perfectly suited to the task because of the exceptional suppleness and dampening qualities engineered into them.

Flexible forks can aid shock absorption on a mountain bike but they have drawbacks due to the fact that they behave like *undamped springs*. ("Undamped" means they continue to bounce after impact. Imagine riding a motorcycle with springs but no shock absorbers: the harder you ride it the less control you would have).

Bicycles usually have unsprung forks (no added springs or shocks) because of their simplicity and light weight. Sprung forks with springs and/or shock absorbers rarely appear on bicyles because of high weight, complexity, mechanical play and rider energy absorption.

To do its job, a fork obviously needs to flex. Preferably, it should flex only in the vertical plane. Unfortunately, some forks also flex excessively in other ways, such as side to side and by twisting. These other ways are undesirable because they detract from controlability of the bike and do nothing to enhance comfort. Heavier wheels and rough terrain make the forks of a mountain bike more prone to twisting

than those of other types of bicycles. A well-designed mountain bike fork should eliminate most side to side and twisting types of flex. A good way to test this important quality is to place the front wheel of your bike firmly between your legs and try to turn the handlebars from side to side. Better forks will display less twisting motion.

A fork with very flexible blades will typically give a softer, more comfortable ride a low speeds, but will make the bike harder to control at higher speeds, over rough terrain and during hard braking.

A rider that places a high priority on maximum comfort and rarely uses the front brake hard may not need a stiff fork, while a rider that has a powerful front brake and uses its full capacity, can appreciate the stability that the stiffer fork styles afford. Rider weight is also an important factor in fork selection. Light riders can use a more flexible fork than heavy riders and have comparable ride qualities.

Straight blades versus curved

Straight forks have shorter blades than curved forks. When the blades are directly between the dropouts and steerer, they are able to more effectively resist the significant twisting loads that the front wheel can create when it hits something like a rock or a diagonal rut.

Curved forks have longer blades. Assuming equal offset, gauges, sections and materials, they will flex more in all possible directions than the straight fork. With all else equal, a curved fork will usually provide more comfort at low speeds.

Crown design

I consider the round-tubular shape to be the best possible for the fork crown area. Any other shape like tubular-oval, tubular -square, cast-solid, I-beam, or flat plates do not use the material as efficiently. When round tubing is used in the crown, The gauge and section can be chosen to produce any effect that other shapes provide but at lower weight.

Your choice

The ideal balance of flexibiblity and stiffness in a fork is a matter of individual needs and preferences. I offer three different fork styles that cover a wide range of needs. Fork choice is important and should be carefully considered.

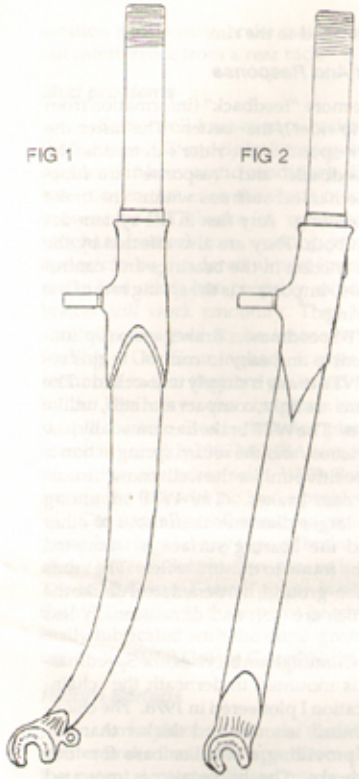
Unicrown Fork

The common "unicrown" fork is popular with builders because it is easy and inexpensive to manufacture and has a nice appearance. Its high flexibility and relatively low strength help protect light gauge steel frames from fatigue cracks and from bending in crashes. Its drawbacks—undesirable resonsances and "autosteer" —show up under agressive riding. The new Koski fork is a similar design but with improved blade design which results in much better performance. I offer a Cunningham-built fork with straight Koski blades, available with cantilever or Speedmaster brake bosses, which I recommend for light riders.

TYPE I FORK (FIG 1)

A Cunningham-designed Type I fork is standard on Cunningham framesets. The crown is round-tubular 4130 chromoly, manufactured by myself,with carefully formed oval sockets which receive special Reynolds oval blades. The oval blade-tubular crown design produces a shape that excels at shock absorption while resisting undesirable twisting and flex from braking. The Type I is a beautiful, curved fork that gives a reponsive, comfortable ride and has strength well-matched to the unusually strong Cunningham frame. I consider it to be the best fork for riders who value comfort with minimal loss of performance potential. The Type I is available with cantilever or with Speedmaster brake bosses.

FIG 1 FIG 2



TYPE II FORK (FIG 2)

Another option is the classic original Cunningham Type II design. This fork is suggested for racing . It also is fabricated from a Cunningham made 4130 tubular crown, but uses straight, round, large diameter, thinwall, internally butted blades. It is the most labor-intensive of the forks I build, requiring an unusual level of skill and craftsmanship. It weighs only about 1.6 lbs and is unusually strong for its light weight. Although it gives a slightly harder ride than the others, it is neverthless characterized by unusual "dampness". Many riders, including myself, have observed that this fork resonates the least after the wheel hits an irregularity in the road and it has been found to be the most stable under braking, at high speeds and on rough terrain. This fork is well suited to performance riding, where maximum control is worth a slight loss of comfort.

The steerers on all Cunningham built forks have extra wall thickness in the crown race area compatible with the strong crown and blades. The Type II fork comes only with WTB Speedmaster brake bosses.

Koski fork —no extra charge
Type I —no extra charge
Type II—$95
All three forks have a 2.0" offset.

THE WTB SPEEDMASTER ROLLER CAM BRAKE (FIG 3)

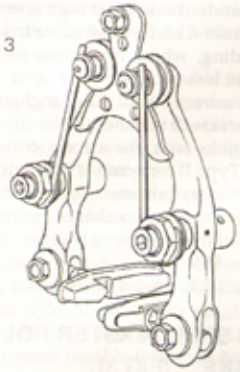
The patented original WTB Roller Cam Brake is, without question, the finest brake available for all terrain bicycles. It is the outcome of a developmental effort that began eleven years ago, when I needed to design a brake system for my own bike which perfectly suited the unique and new requirements of ATBs. This brake is mechanically very different from the Suntour versions and is not hampered by mud and other functional problems associated with the mass-produced brakes.

I began by experimenting with various mechanical brake systems, gaining design insight both from personal experience, and the many different riders who tested the prototypes. This led to the choice of the cam-and-roller principle as the most suitable for reasons too numerous to mention here. This ancient concept has been adapted and refined in the WTB brake to meet the needs of the modern offroad bicyclist.

The WTB Roller Cam Brake is a light(195 gm per wheel), simple, highly evolved design with many important proprietary features that

are patent protected. This brake noticeably out performs any other brake on the market in the following ways:

FIG 3



Peak Mechanical Advantage

The WTB Roller Cam Brake has greater peak mechanical advantage and controlability than any other brake available and unlike others, the power level *can be tuned*. For instance, the rear brake can be set up to have more power than the front by changing the ramp angle on the cam - - an easy adjustment. "Greater peak mechanical advantage" means that, where another brake might level out in stopping power, the WTB brakes can continue to apply pressure. Result? No white knuckles.

The special shape of the WTB cam uses minimal cable travel to move the pads into contact with the rim. The "ramp" of the WTB cam then takes over and provides great mechanical advantage to squeeze the pads against the rim. This translates to less cramping of the hands during long, difficult descents. The excellent "feel" and "control" of the brake is due to the fact that most of the cable travel serves to modulate stopping power, not merely advance the pad to the rim.

Feedback And Response

The more "feedback" (information from the brake to rider), the better. The faster the brake can respond to the rider's demands, the better. "Feedback" and "response" are functions of mechanical stiffness within the brake and its mounting. Any flex in the system detracts from both. They are also affected by the amount of friction in the bearings and control linkage. Also important is the spring rate of the return springs.

WTB Speedmaster Brakes are exceptionally predictible and easy to control. In this regard, The WTB brake is simply unexcelled. The caliper arms are light, compact and stiff, unlike other brakes. The WTB brake has unusually low internal friction, and the return spring action is crisp and positive unlike the well-known, mass-produced cam brakes. The WTB mounting studs are larger diameter than those of other brakes and the bearing surface is mounted closer to the frame to minimize flex. The studs are precision-ground, hardened steel unlike the others, which are soft and dimensionally less precise.

On Cunningham bicycles, the Speedmaster Brake is mounted underneath the chainstays, a location I pioneered in 1978. The chainstays are much shorter and thicker than the seatstays, providing a sturdier base for this powerful brake. The brake also is mounted nearer to the ends of the tubes which is better. Reducing stay flex in this way reduces the possibility of "brake squeal", and gives the rider more accurate control. Note how much the seatstays flex on bicycles with brakes mounted there. This flex ruins the potential of even the best brakes. They become mushy and loose controlaccuracy.

Mounting the brake under the chainstays also helps protect the brake from damage in a crash, and keeps the projecting parts of the brake from injuring the rider. The chainstay

location allows easy brake maintenance without interference from a rear rack.

Mud problems

Some well-known cam brakes (such as the Suntour X.C. and Sport) are reputed to have problems in heavy mud conditions. Experience has proven that even the worst mud does not prevent the WTB brake (as mounted on Cunningham frames) from working properly. Bicycles can be rendered almost immovable by really bad mud, but properly mounted WTB brakes *still* work smoothly. They have been carefully designed to be insensitive to mud fouling. On Cunningham frames they are mounted so that they are protected from mud by the chainstays, the chainstay brace, and a simple, custom fitted deflector plate. At the incredibly muddy 1983 NORBA National Championships, the bikes with WTB Brakes were among the few with no brake problems.

Constant all-weather use can cause the main pivot bearings on any type of brake to become sticky unless a lubrication means is provided. The WTB Grease Guard option is standard on the WTB brake so these pivot bearings can be easily lubricated with the same grease gun we use on the WTB Grease Guard Hubs.

Return Springs

An important feature of the WTB Speedmaster Brake that sets it apart from all others is the patent protected linear return spring system, which makes for independent adjustment of spring tension on each brake arm. This independent linear spring adjustment lets the rider tune the hand lever tension to meet his or her own preferences. In the WTB brake the linear springs give much stronger pad centering than brakes with coil springs, because the WTB springs have a higher *spring rate*. This means it's very difficult to deflect the brake pads from their proper rim spacing on a WTB brake. (Compare it yourself with any other brake.) This important proprietary feature maintains proper pad centering, even in severe mud conditions

The price of the WTB Speedmaster mounted on your Cunningham frameset is $135 (front) and $175 (rear). This includes the new ultra low-friction, sealed ball bearing rollers. I remove the standard WTB bushings and stepdown sleeve and replace them with a larger diameter, longer bronze bushing which mounts directly on the oversize Cunningham brake studs. I then machine Grease Guard grooves in each. Each brake arm is then carefully fitted to the brake stud with a special reamer. Cost is slightly higher than the standard item due to the extra work.

I have recently designed a more compact version of the brake, specifically for use on narrow tire tandems, HPVs, and cyclo cross bikes. The WTB Mini Cam is a powerful, sensitive brake that totally outperforms standard brakes. It is made to the same high standards as the Speedmaster. I've used this brake on my personal "Expedition" bike for years, and its power and effectiveness still amaze me. It is an option on my skinny-tire Expedition bikes and is also sold in kit form with complete mounting instructions and jigs. Mini Cam option on Cunningham bikes: $135 (front) and $175 (rear). In kit form, each brake costs $189, or $375/pair.

What About Other Types Of Brakes?

The common cantilever brake is adequate at medium or low speeds, but flexes too much for accurate control and does not generate enough pad pressure to utilize the full traction potential of mountain bike tires at higher speeds. The cantilever mounting stud is a poor design which is quite flexible and prone to damage. The projecting brake can also damage you ! In 1983, Steve Cook's race bike, which had cantilevers, almost didn't make it into the Nationals. A minor crash on a practice lap trashed a rear cantilever stud. It was barely fixed in time. I have never had a Speedmaster stud get damaged, and I have a lot more of them out there.

Lastly, rear cantilever brakes prevent the use of fully sloping top tubes with their many structural and rider benefits.

The plus side of cantilevers is their mechanical simplicity. I do offer them as an option because of their refound popularity but I do not recommend them.

U-brakes (centerpulls) have mechanical advantage which falls between that of a cantilever and a cam brake. They tend to be both heavy and \or excessively flexible, because the caliper arms must be quite long to clear ATB tires.

Self energizing brakes can generate high pad pressure and can easily lock the wheel. They tend to feel "grabby" and are unusually sensitive to imperfections in the rim. The problem inherent with this design is imprecise *unloading* of the pad pressure, which is a peculiarity of the way the internal helix mechanism works. An experienced rider can feel the difference in the way this type of brake loads and unloads the pads. This makes it difficult to modulate brake pressure accurately.

More Information On Brakes

A complete survey on the subject of mountain bike brakes can be ordered through WTB.

WILDERNESS TRAIL BIKES BRAKE PADS (FIG 4)

WTB has a new type of brake pad which we compounded specifically to solve several common problems: 1) It is ideal for breaking in new rims with anodized surfaces or imperfect joints. 2) It provides much better wet weather performance than any conventional pad. 3) It is able to eliminate brake squeal in most cases.

FIG 4

The WTB pad holder is of exceptional quality which allows WTB to offer a pad replacement service to our customers after the pad wears out. This new pad will be available through WTB in Jan 89. WTB is developing another more conventional pad as well which will be available later in 1989. For more information call WTB.

THE WILDERNESS TRAIL BIKES GREASE GUARD (tm) COMPONENT SYSTEM:

We proudly introduce the WTB Grease Guard Hubset, WTB Grease Guard Cartridge Bearing Bottombracket and the WTB- KING Grease Guard Sealed Bearing Headset as the first of a full line of WTB Grease Guard bicycle components. The engineering experience, materials, precision machining and care of assembly in the WTB Grease Guard Components are unequaled. The quality and performance, combined with our revolutionary WTB Grease Guard Bearing System, is setting new standards of excellence for all bicycles.

Following is an explanation of what the WTB Grease Guard Bearing System is and how it works:

THE PROBLEM:

Active cyclists know how quickly the bearings on a bicycle can rust, wear, and degrade to the point where they require adjustment or replacement. Too much time and expense has been required to maintain the bearings on an actively used bicycle, especially one used under all weather conditions. Improved bearing seals and better greases have helped to solve the problem, but their effectiveness is limited. No matter how good the bearing seals are on any given component, water and contaminants always find a way in and begin doing damage.

The Grease Guard concept was insipred by necessity. I ride quite a few different bicycles under all weather conditions. I am also responsible for maintainence on a whole fleet of team competition bikes that receive brutal, all weather use in training and racing. Before Grease Guard, I was wasting too much time cleaning or replacing bearings. It wasn't fun. I'd rather be riding. Thus was borne my friend and helper: Grease Guard! Now I hardly ever have to mess with bearings.

WTB solves the problem by purging and relubricating each individual bearing from the protected inside edge to the exposed outside edge. With Grease Guard Components, Goose Grease and the small hand held WTB Grease Gooser you can accomplish a bearing overhaul in seconds.

HOW BEARINGS FAIL

A common example of seal leakage is found when the bike is at ambient air temperature and is then brought in contact with cool water (rain, stream crossings, and wash water are typical). The cooling effect of the water causes the air in the bearing cavities and nearby tube chambers to contract, which in turn sucks water and abrasive contaminants past even the best seals into the bearing. This situation is common on all bikes and demonstrates why seals alone have not provided adequate bearing protection.

Our experience has shown that three different mechanisms contribute to the degradation of bearings in bicycle components:

1)Abrasion from grit which enters the bearing (usually in the form of mud or water borne particles.)

2)Corrosion caused by water which enters the bearing. The water causes pitting and abrasive oxides form which pit and erode the metal.

3)Wear from normal motion. Experience shows this to be very small in comparison to abrasion and corrosion. The low speed, high-load situation found in bicycles favors the use of precision cartridge bearings when kept clean.

We are led to this conclusion by the long life of the bearingst in Grease Guard Components if they are lubricated diligently. In proof, bearings subjected to almost daily off-road use in all types of weather have no more detectable play than the day they were installed over two years ago.

The Wilderness Trail Bikes Grease Guard Components are the first real solution to bicycle bearing abrasion and corrosion problems.

THE WTB SOLUTION:

Wilderness Trail Bikes has designed and applied for United States and foreign patents on a componentry system with seals that incorporate bearing protection called Grease Guard, which is equally effective with cup and cone or cartridge bearings. Grease Guard is a carefully thought out and tested means by which the various bearings on the bicycle can be selectively flushed with our special, waterproof Goose Grease. This system effectively solves the problem of wear from contamination.

The frequency of neccessary lubrication varies with conditions: In wet weather or after stream crossings they should be greased at the end of each ride; in dry weather once every week or two is enough because the standard bearing seals are fairly effective at keeping dry dirt and dust out.

OTHER GREASE SYSTEMS

The Grease Guard System differs in three very important ways from the more primitive systems which are beginning to appear. These systems simply fill the whole cavity between the bearings with grease which causes problems.

1. UNIFORM CLEANING AND REPACKING

With Grease Guard the grease flows through the bearing uniformly from the inner protected side to the outer exposed side. In cruder systems one of the two bearings usually does not get adequate grease due to pressure variations. Where the contamination is worst within the bearing is where the most resistance to fresh grease will be. The other systems fail to put the grease where it is needed most.

Each bearing must be independently lubricated. Grease Guard insures that there are no air voids or grit left in either bearing after greasing so that it is harder for contaminants to re-enter the bearing.

2. FRICTION FROM GREASE SHEAR

Bicyclists don't need more friction, they need less. A normal cyclist has only about one-half of a horsepower at his or her disposal. Unlike motor vehicles, cyclists can't afford to waste their output overcoming excess friction. With the WTB System, the inner Grease Guard seal barely contacts the moving parts. It flexes during greasing which forms the seal so it can do its work. The result is extra-low bearing friction, and exceptionally long life.

The cruder systems fill the whole cavity which causes large amounts of grease to constantly be "sheared" as the parts turn. Your precious energy goes into churning grease which is akin to turning the handle on an ice cream maker, especially on cold days.

3. WEIGHT

Considering the effort and expense todays's bike builders and users put into having light and efficient bikes, adding a pound or so of grease to the frame doesn't make sense. It may not be noticed by novice riders but it definitely bothers most experienced riders.

WTB's Grease Guard System is very different from the cheaper "stone age systems". It is designed by people who care enough to do it right.

WILDERNESS TRAIL BIKE GOOSE GREASE ™

Our smooth white lubricant provides true protection from corrosion and wear for all moving parts on today's mountain bikes. Although Goose Grease is made specifically for use in WTB Grease Guard componenets, it is also ideal for seatposts, cables, pivots, threads and any other area of your bicycle needing low friction, all weather protection. Goose Grease contains microscopic Teflon which plates the metal parts under pressure for exceptionally low friction qualities. It is non-toxic. Available from WTB.

WILDERNESS TRAIL BIKES GREASE GUARD HUBS (FIG 5)

The Wilderness Trail Bikes Grease Guard Hubs are made in the USA of the finest aluminum and machined to precise tolerances from solid billet to assure maximum strength. They are polished and clear or black anodized to protect the fine appearance. Our design optimizes the location of the freewheel with respect to the hub flanges so that the wheel has a better spoke bracing angle. The contour of the spoke holes greatly reduces stress at the spoke bend for stronger, more durable wheels. This hubset has four small aircraft ball check grease fittings which accept the WTB grease gun. They will outperform and outlast any other hubs on the market. Available thru WTB in 32 or 36 hole.

My written recommendations for wheel configurations are available from WTB. Also available is my commentary on the pros and cons of freewheel hubs and cassette hubs.

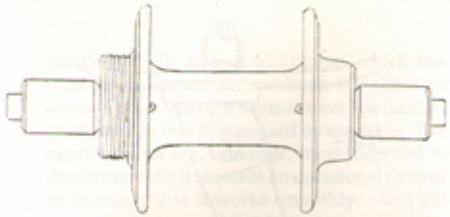
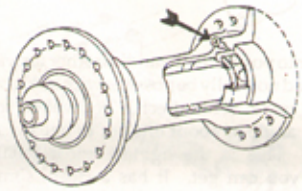


FIG 5



CUNNINGHAM MODIFIED HI-E SLO RELEASE SKEWERS

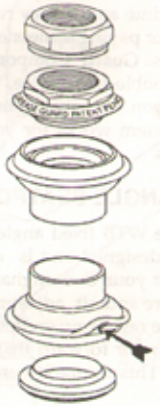
I recommend these simple, lightweight, reliable wheel skewers for your Cunningham. They have rolled threads and use a stainless pin for tightening. $28.50 per pair with stainless pin.

WTB/KING GREASE GUARD ™ HEADSET (FIG 6)

WIlderness Trail BIkes has worked closely with Chris King to manufacture his popular headset with our Grease Guard system. This and some other similar designs which accomplish the same end are patent pending.

For this headset Chris King uses only the finest US made materials. Sold exclusively by WTB, available in either black or silver, this fine headset can now be kept clean and free of grit by greasing with the WTB Grease Gooser. This headset is not as susceptible to maladjustment as other ball bearing headsets, due to the nature of the custom made thrust-type sealed bearing. (Incidentally, needle-bearing type headsets do not allow the small amount of movement or "give" neccessary to accomodate the flex in the steerer tube which occurs in normal riding. They can cause acute stress on frame and fork and are responsible for many "mystery breakages"). The WTB-King headset will allow steerer flex which protects the parts when great forces are applied to the fork. The lower race of any headset is exposed to the most contamination from the front wheel. If the corrosive elements are not removed, the bearing steel and ball bearings themselves will become pitted and worn. Any headset run while loosely adjusted will cause the lower race to be hammered, hastening failure. If the WTB-KING Grease Guard headset is properly adjusted and greased promptly after wet rides, it will give exceptionally long, trouble-free service. *This headset is standard on Cunningham bikes.*

FIG 6



WTB GREASE GUARD BOTTOM BRACKET

The patent pending WTB Grease Guard Bottom Bracket was originally developed for use on Cunningham bicycles and is now *standard on all Cunningham bikes.* It uses press-in cartridge bearings, each with two laser drilled holes and a circumferencial groove. A contoured, stainless backup washer prevents grease leakage to the inside of the bottombracket shell. Included is the indestructible WTB designed, King made,heattreated stainless bottombracket spindle. The WTB bearings are dimensionally identical to the standard 17x35mm ones which are available everywhere so they can be interchanged if necessary. The WTB Grease Gun and WTB Goose Grease are used for easy, fast lubrication.

GREASE GUARD COMPONENTS SUMMARY:

Until now, bicycle bearings just wore out and needed replacement. The WTB Grease Guard components give you full control over bearing wear in your bicycle. There is a definite satisfaction in being more self-reliant. With WTB Grease Guard Components you will spend a lot less time and money replacing worn-out bearings or paying someone else to do it. Our new Grease Guard Components will provide years of trouble-free service. We appreciate any feedback you can give us on how our Grease Guard System works for you in your riding conditions.

FIXED ANGLE SEATPOST (FIG 7)

The WTB fixed angle seatpost is Cunningham designed and is offered in various lengths for your Cunningham bike. It allows normal fore and aft adjustment of the saddle. The saddle rail clamp on this seatpost is about an inch farther forward than with most other seatposts. This unique feature makes it possible

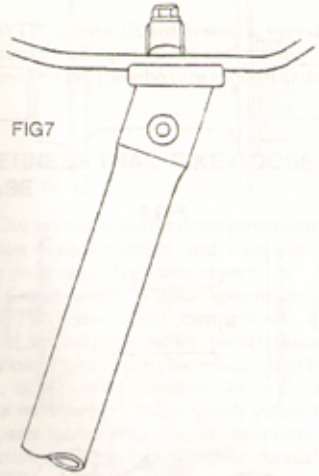


FIG7

for a rider to position the saddle farther forward than would normally be possible with any given seattube angle. (The effect is equivalent to a seattube angle of about onehalf to one degree steeper.) This is the lightest, most reliable seatpost you can get. It has a clean, simple appearance. Its limitation is that once the angle is set properly, a change of saddle types sometimes requires a readjustment of the angle, a process which involves some careful filing. (I will re-mill the angle for $15) Add $62 to price of frameset for this option.

LIGHT WEIGHT CUSTOM SEATPOST QUICK RELEASE (FIG 8)

The Cunningham designed quick release is based on a cam-lever principle and is made

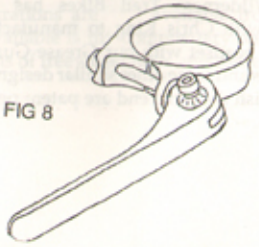


FIG 8

out of 7075-T6 aircraft aluminum which has been polished and clear anodized. It is about an ounce lighter than the normal steel Specialized quick release that is standard on the bikes. The moving parts are, however, more exposed to the elements so it requires an occasional drop of oil to insure that it works smoothly. Add $55 to price of frameset for this option.

FITTING YOU TO YOUR NEW BIKE WITH THE FITFINDER (FIG 9)

I have developed an adjustable stem called the FITFINDER (tm) which I recommend to new Cunningham owners. It allows you to

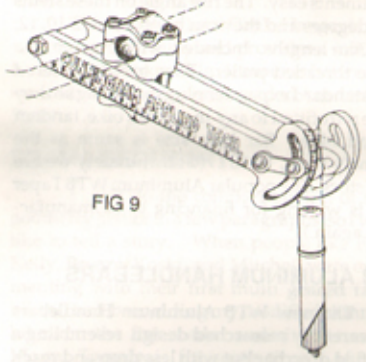


FIG 9

experiment with different handlebar positions while actually riding your new bike. Its use ensures that the custom stem which I build for your new bike will fit perfectly. My dealers have FITFINDERS which are available for your use when you get a Cunningham. For written information or to place FITFINDER orders call Janis at (415) 461-7405. They are in stock . $235

CUNNINGHAM CHROMOLY STEMS (FIG 10-and 11)

Originally a Cunningham concept, the WTB Taper System is light and strong. It is based around a 4130 tube with a precision tapered end which is silver brazed into the steerer. A single, domed stainless steel bolt passes through an aluminum adaptor in the end of the stem and threads into the taper. As the bolt is tightened,

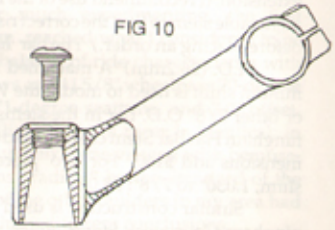


FIG 10

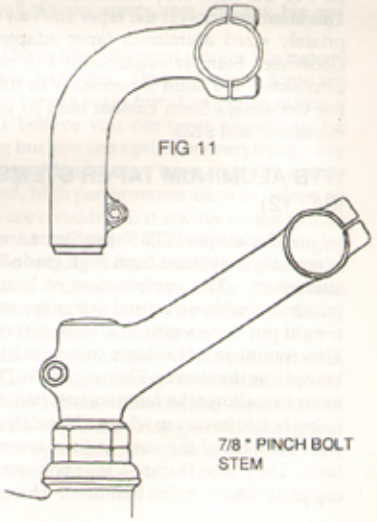


FIG 11

7/8 " PINCH BOLT STEM

the slotted adaptor expands and locks the stem to the tapered tube. This unique system has beautiful, clean lines and avoids pinch bolts or sharp edges in the back which can cause knee injury. The WTB Taper System is also able to receive an unslotted 7/8" OD adaptor for standard pinch bolt style stems to mount on.

The Cunningham Taper Stem For Flat Bars is fillet brazed 4130 tubing with the joints carefully smoothed and then painted with silver Imron. They can be ordered in any rise and extension. (I recommend use of the FITFINDER adjustable stem to find the correct rise and reach before placing an order.) The bar hole is 1.030" I.D. (26.2mm) A machined 2 piece aluminum shim is used to mount the WTB Flatbar or other 7/8" O.D. bar in the stems. For Cunningham Flat Bar Stem custom made to your dimensions add $160. For two piece handlebar shim, 1.030" to 7/8": $8.00

Similar construction is used in the Cunningham Gooseneck Stems which position the bars higher and are made expressly for drop bars or the new WTB Heattreated Drop Bar. This stem mounts on the taper with an appropriately sized aluminum taper adapter. The Gooseneck Stem is available in any rise and extension. No shim is necessary in this case. For Gooseneck Stem custom built to your dimensions add $175.

WTB ALUMINUM TAPER STEMS (FIG 12)

The unique WTB Taper Stems are works of art, fully machined from high grade 7075-T6 aluminum. The combination of beautifully polished finish, structural integrity, and light weight put these stems in a class of their own. They mount on a 4130 taper tube which is silver brazed into the steerer. This original WTB Taper mounting allows the 6mm socket stainless steel fixing bolt to be on top where it blends perfectly with the form of the stem and the knees won't hit it. They also feature a four bolt removable cap plate which makes handlebar changes and adjustments easy. The rise angle on these stems is 25 degrees and they can be ordered in 10, 12, and 13cm lengths. Included with the stem is a simple threaded puller. They are also offered with standard expander plug mounting so they can be retrofitted to any mountain bike, tandem or road bike. Bar hole size is same as the chromoly stem, 1.030". (Unfortunately we are out of stock. The popular Aluminum WTB Taper Stem is waiting for financing to be manufactured again.)

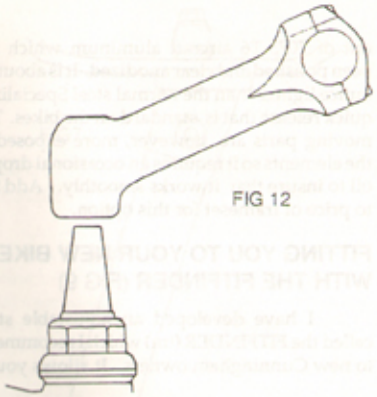


FIG 12

WTB ALUMINUM HANDLEBARS

The new WTB Aluminum Handlebars are a carefully researched design resembling a modified drop bar but with less drop and reach and a slightly different hand angle. The bar combines the advantages of drop bars and flat bars. It is normally used with drop bar brake levers and the WTB Shifter Adaptors which mount on the inner sides of the bar near the brake lever. (These WTB Shifter Adaptors accept Shimano SIS or Suntour Accushift shifters.) The WTB Aluminum Bars are made of special gauge heattreated aluminum tubing with an integral sleeve which eliminates the need for the 2 piece shim. WTB Alum Bars and WTB Shifter Adaptors are available thru WTB.

WTB PEDAL FLIP

The WTB Pedal Flip mounts on the rear of the pedal and is sold in pairs with mounting hardware. It is designed expressly for touring or racing use with touring type shoes and toe clips. They allow the foot to get into the clips very quickly and easily with one clean stroke. They are made of plated spring steel and the shape has been perfected by years of testing. It is very advantageous for cyclo-cross or when doing trail riding where dismounts and remounts are frequent. They were used by nine of the top ten racers at the 85 NORBA Nationals. WTB Pedal Flip, $9.95 pr.

CUSTOM ALUMINUM FRONT BRAKE CABLE HANGER

The Cunningham Cable Hanger is made of high strength alloy and provides a solid stop for the front brake cable. It mounts between the top nut and the upper threaded headset cup. $9.50

FRAME GEOMETRY

I can't do the complex subject of frame geometry justice in a few paragraphs, so I would like to tell a story. When people like Fisher, Kelly, Breeze, Koski, and Mitchell were experimenting with their first multi geared fat tire bikes, I had been riding my modified skinny tire bikes on the fire roads and single tracks of Mount Tamalpais for some time. After test riding many of the existing fat tire bikes and carefully noting their various ride qualities, I started building my first mountain bike. The wheelbase, angles and fork offset were changed several times in the months following its completion by cutting and re-welding.

I discovered a critical ratio between chainstay length and wheelbase, which must be maintained if the bike is to drift evenly in a slide. I learned that steeper head angles need to be accompanied by reduced fork offset in order to maintain reasonable trail. Less fork offset with a steeper head angle will result in more pounding to the rider. The pounding can be reduced with a softer fork, but that in turn detracts from front end control, particularly during fast riding and hard braking. Very short bikes are really fun to ride but they have an unavoidably choppy ride due to the closness of the contact patches to each other. The price is more rider fatigue on long rides. And so on and on....

After much experimenting, the first Cunningham reached what I considered to be the perfect balance of ride characteristics with 17" chainstays and 41 5/8" wheelbase 70-degree headtube, 71-degree seattube, and 2.0" offset. Sound familiar? Today's racer is identical. In those days, the bike was viewed with bemusement. It was "radical" by the standard of the day. Most of the other builders in my area had come to entirely different conclusions.

I still experiment with different geometries and own mountain bikes that are all combinations of short, steep, long, shallow, big and small.

I have tried different gauges, diameters, materials, and sizes. They all work. Some are better in certain ways but at a price in others.

I believe you can't get something for nothing but you can optimize everything. My overall goal has always been to build a well-balanced, high performance bicycle. When all factors are considered, it always seems to lead back to the same basic dimensions and angles that produce this *optimal balance of of qualities*. I can adjust and tailor these basic dimensions when neccessary to produce predictable differences in handling and rider fit.

In summary, I expect the current trend in mountain bike geometry to continue to the natural limit of that thinking and then return to more realistic ground. I suggest that it is wise to keep your eyes open, test prevailing ideas, and always think for yourself.

SEATTUBE ANGLES

A frameset should have good weight distribution when the rider is in his/her most ergonomically efficient position.

The seattube angle affects the for/aft saddle location which is very important to the balance and ergonomic efficiency of a bicycle. There are lots of mountain bikes these days with 73-degree, 74, or even steeper angles.

My mountain bikes are built with 71or72-degree seattube angles. This is based on experience. The reasons are:

1)The 71-72 degree seattube angles allow two different muscle groups to be used during climbing. When in the saddle, the group used in standup climbing can recover, and vice-versa. If you have tapes of the 88 Tour de France, check the saddle positions of the leading riders in the mountains. The top climbers use relatively rearward saddle positions for this reason and others. The principle applies to mountain bikes as well.

2) The steeper the seattube angle, the higher and farther forward your body will be. The 71-72-degree angle avoids excessive front wheel loading, keeps your center of gravity low, and improves cornering stability and aerodynamics. (A longer front center dimension could correct the excessive front wheel loading but would create poor drift characteristics and ruin low speed nimbleness.)

3) Shallower seattube angles dissipate some of the shock that is transmitted up through the saddle better than the steep angles. The loads from your body weight at the saddle cause the seattube to flex in an arc slightly more which makes the ride a little smoother and less fatiguing.

4) The shallower seattube angle favors the muscles used in the low cadence, high load riding style which is typically used by top mountainbikers. I have observed that when climbing in loose dirt or rocks, the low cadence, high leg-power riding style makes much better use of the available traction than a style that tries to"spin the gears".

I ride a bike with 17" chainstays, a 71 degree seattube and the tip of my saddle is 3.375" behind a vertical line thru the bottombracket. Some would claim that I should be uncontrollably lifting my front wheel on steep climbs, but to the contrary, the geometry of the bike makes it possible for me to modulate the location of my weight by moving around on the saddle to maintain maximum traction (front wheel just shy of lifting). I can also easily loft the front wheel over obstacles when necessary. Then on descents, my saddle location allows my weight to be well to the rear and low on the bike for better stability.

Although I prefer 71 or 72 degree seattube angles, the ideal location of saddle with respect to bottom bracket can vary from one rider to another depending on build, leg length, and riding style. If someone feels they have special needs with regard to saddle location, I will build the bike accordingly. For example, a dedicated or professional road rider who wants a mountain bike for cross training may want the saddle position with respect to bottom bracket to be nearly identical to that of the road bike to avoid possible joint injury.

THE CUNNINGHAM FRAME SIZE DESIGNATION

Most Cunningham mountain bike frames are built with sloping top tubes. Size is designated by two numbers. For example, with a 20" x 17 1/2" frame, the first number means that if the frame had a horizontal top tube, the dimension from the center of the bottom bracket to the top of top tube (along seattube axis) would be 20". (The 20" indirectly specifies headtube length, which in this case is 4 13/16 "long. The headtube length of 21" frames is 5 7/8" and the 22" frames have a 6 3/4" headtube). The17 1/2" dimension indicates the *actual* center of BB to top of top tubealongseattubemeasurement.

HEADTUBE LENGTH

I do not like to build bicycles with headtubes shorter than about 4" ! Headtubes shorter than this are bad design because they place huge loads on the headset bearings, steerer and frame. They cause rapid wear in headsets and can cause frame or fork failure. (I cringe when I see bikes with little 3" headtubes- they are sure trouble for the owner.) A structurally better way to obtain a lower toptube is to slope it downward from the headtube. If you are planning to use drop bars I prefer to build your frame with a headtube about 1" longer than what it would be for flat bars. Because drop bars mount higher, it is better for the stem to be shorter with the headtube correspondingly longer

FRAME CONSTRUCTION

The frames are constructed from large diameter 6061 aluminum tubing which is TIG welded in an unus ual jig designed to insure perfect alignment. The choice of tubing size and wall thickness throughout the frame is based on many years of experience. The tubing is carefully tailored to obtain the balance of flexibility and\or stiffness which is optimal for each area of the frame. Butted tubing is used to increase structural efficiency in some parts of the frame. The problems usually associated with TIG welded steel frames such as the small size of the weld bead resulting in stress concentrations and also weld zone embrittlement caused by high cooling rate are not present in a properly built aluminum frame.

After welding, Cunningham frames are heattreated in a carefully controlled sophisticated process which completely stress relieves the welded aluminum and brings it to its full strength (the T-6 condition). Maintaining alignment during the process is crucial. A process based on much testing and experience is used to accomplish this. Each frame receives two alignment checks during its manufacture. The frames receive several unique, secret proprietary treatments that really distinguish them from all other welded aluminum frames.

Cunningham offroad frames have always had an unusually wide bottombracket shell for better spindle support and extended bearing life. The special WTB designed Chris King stainless steel spindle has exceptional strength. The cable core guides are made of carefully formed stainless steel parts which are silver brazed together by hand. These and the unique Cunningham machined aluminum cable stops are attached to the frame using techniques derived from the aerospace industry. More desirable than cable-housing guides, cable stops allow crisp brake and derailleur control.

FRAME COLORS

For $110 additional, the frame, fork, and stem can be painted your choice of Imron colors.

I can create an even more strikingly beautiful effect where all of the joints are made perfectly smooth by hand file work and the use of a special low density filler before painting. The process requires days of labor but results in an incredible dimension of beauty that will appeal to those with a refined sense of aesthetics. This option is $450.

FRAME GEOMETRIES

I build three distinctly different mountainbike framestyles; the INDIAN, the RACER, and the LITTLE PEOPLES BIKE. The geometries of each are the result of knowledge accrued from countless hours of offroad riding by myself and other experienced riders. The geometry listed for each style of bike is optimal for most riders. I may adjust it slightly to accomodate special needs.

THE INDIAN

This bike is named with regard to the Native Americans who lived here before us, and whose respect for and attunement to the

land is a model for contemporary lovers of the wilderness. The Indian is designed with moderate angles and wheelbase which make it a practical, all around bike with very forgiving handling qualities. The Indian is "user friendly". It is stable, well balanced and comfortable to ride for long periods. This frame has plenty of clearance for 2.2" tires. What this geometry gives up in nimbleness, it returns in comfort. You can ride this bike off road all day and feel relaxed and at ease on the bike at the end of the day.

INDIAN Geometry:

Fork offset	2.0"
Wheelbase:	42.8"
Chainstays:	17.3"
Bottombracket:	11.875" with 2.125 tires
Headtube Angle:	70 degrees
Seattube Angle:	71 deg (72 on 22&23" frames)
Seatpost Diam:	27.0mm is used unless oversize is specified
Rear dropout spacing:	135mm
Sizes available:	19, 20, 21, 22, 23"

THE RACER

The Racer is a shorter frame which gives it quicker handling. The short chainstays allow a greater percentage of weight to transfer to the rear wheel when climbing out of the saddle, and the short wheelbase makes it easy for the rider to rapidly modulate wheel loading. This bike is quick and nimble and requires more attention from the rider and experience on fast decents. The Racer excells on narrow single track trails and steep climbs. Its handling on decents is quick and accurate. Its nimble, responsive nature makes it popular for racing and fast, lightly loaded touring. The Racer is my favorite bike. This frame is built with full clearance for the 2.2" tires.

RACER geometry:

Fork offset:	2.0"
Wheelbase:	41.75"
Chainstays:	17. 0"
Bottombracket:	11.875" with Ground Control Tires
Headtube angle:	70 degrees
Seattube angle:	71 deg(72 deg on 22" fr.)
Seatpost diameter:	27.0mm is standard unless oversize is speced
Rear dropout spacing:	135mm
Sizes:	19, 20, 21, 22"

THE WOMBAT

Designed for the many people who are unable to find a proper fit on conventional small mountainbikes. In 1980 this new mountainbike frame configuration set the standard for small frames which has been copied by many. This bike, with its exceptionally low sloping toptube is tailored to the needs of smaller people.

The bike uses normal 26" wheels instead of the 24" wheels sometimes offered on other bikes, which compromise efficiency and handling qualities. The design also avoids the tiny headtube found on many small frames which puts enormous loads on the headset bearings. This is accomplished by sloping the toptube and seatstays downward, which is not possible with cantilever brakes because the rider's heels would hit them. It is possible though, with the compact WTB Roller Cam Brake which also dramatically increases stopping power.

Presumably the shorter person is also lighter, and can appreciate a 24 lb bicycle. The people currently using them include a national class woman racer, an offroad tour leader, and a Harvard professor. Each has his or her reasons for a top quality bike, and each is overjoyed to have a bike that fits and handles perfectly. The frame is built with full tire clearance.

WOMBAT BIKE Geometry:

Fork Offset	2.0"
Wheelbase:	41.5"
Chainstays:	17.0"
Bottombracket:	11.6" (with Ground Control Tires)
Headtube angle:	70 degrees
Seattube angle:	71degrees
Seatpost Dia:	27.0mm
Rear dropout spacing:	135mm
Size:	One size for those who would normally need a frame smaller than 19".

EXPEDITION BIKE

This is a rugged skinny tire bike which is built for tires up to 35mm or 1.375". The bike is a light 20 lbs with Specialized Expedition or Tri Cross tires. I have enjoyed my own Expedition Bike so much that it has inspired me to build this incredibly practical and fun bike for others. My appreciation of this type of bike stems from the fact that it is very efficient on pavement, while being tough enough to go anywhere a mountain bike can go with a little rider finesse. The bike is ideal for efficient travel over varied terrains, including pavement. With lighter tires it can double as an excellent road bike. The Expedition Bike is sold as a complete bike with the following specs:

WTB Mini Cam Brakes on rear, Mafac cantilever front brake, Cunningham Type IV Fork with Tubular Crown, Cunningham 4130 Taper Stem, WTB-KING Grease Guard Headset, Araya 20A clincher rims, Wheelsmith spokes, WTB Hubs, and MP-1000 pedals.

The bikes have a 27x1.375" wheel on front and a 700Cx35mm on the rear for better handling. The sloping toptube/ large diameter seatpost option is also available on these bikes. Price is about $3200 depending on componentry and options.

Expedition Bike geometry:

Fork Offset:	1.75"
Wheelbase:	40.375"
Chainstays:	16.375"
Headtube:	72.5 deg
Seattube:	72.5 deg
Seatpost:	27.0 mm is standard unless oversize is speced
Dropouts:	135 mm
Sizes:	19,20,21,22,23"

If your needs can not be met with any of the bikes above, I am willing to build frames to your specifications if your request seems reasonable and I have time. Depending on the changes this may cost more due to increased set up and handling time.

SLOPING TOPTUBE AND LARGE DIAMETER SEATPOST OPTION

The Indian, Racer and Expedition Bike frames are available with a sloping toptube and large diameter seatpost, a configuration I pioneered in 1978. This option uses the the frame material more efficiently ,saving .5 to 1.0 lb. (by using less tubing) and further stiffens the bottombracket area for added energy transfer efficiency. The big seatpost can tol erate greater extension because of its greater strength. This in turn allows more slope in the toptube.

The sloping toptube gives added crotch clearance which can be used to great advantage on difficult terrain such as rough trails or steep decents. This type of frame is easily shouldered for carrying, but there is usually not enough room to hook the arm around the toptube for the classic "cyclocross carry". *This option does not change the handling of the bike,* as the geometry is unchanged.

The greater surface area of the large seatpost creates more sliding friction. People that raise and lower the seatpost a lot would be

better advised to use the standard size seattube which can be sloped but to a lesser degree.

The other drawback of the big seatube option is that your seatpost and front derailler are non-standard which is something to be considered if you are touring in distant lands. Add $320 for this option.

FRAMESETS, COMPONENTS AND SERVICES

Here is what is included in the Basic Cunningham Frameset:

Type I fork; WTB-KING Grease Guard Headset; standard size, replaceable WTB Grease Guard Bottombracket with special WTB designed Chris King stainless steel spindle; Specialized seatpost quickrelease with Cunningham Collar; Suntour XC or DeOre XT seatpost; front and rear brake posts; Suntour Cyclone II front derailler for double front chainrings, or Shimano Deore for triples; two water bottle cage mounts; all necessary cable stops and guides; rack bosses on dropouts. *The various options listed elsewhere can be substituted or added to the basic frameset.*

INDIAN frameset:	$2025.00
RACER frameset:	$2426.00
WOMBAT frameset	$1722.00

SERVICES

For an extra waterbottle cage mounted under the downtube: $32.50

Replace your bottombracket bearings: $15 labor (if cranks are removed)

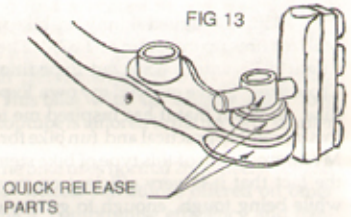
Retrofit your Cunningham Bottombracket for WTB Grease Guard (includes grease gun and new WTB\King spindle) $95.

NEW DESIGNS AND UPDATES FOR EXISTING BIKES:

BRAKE QUICK RELEASE (FIG 13)

This new option for the WTB Speedmaster Brake is a kit which fits on both old style or new style brakes to allow easy wheel removal. The kit includes several parts which offset the brake pad from one caliper arm so that it can swing clear of the chainstay or fork blade. This option is best for people who use large tires, narrow rims, and remove their wheels often. The only drawback is a very slight reduction of brake stiffness, barely perceptible in side by side comparitive tests. $22.50 per wheel.

FIG 13



QUICK RELEASE PARTS

CUNNINGHAM COMBINATION STEERING LIMIT/ CABLE HANGER (FIG 14)

On most bicycles, the handlebars or brake levers act as a natural steering stop by contacting the toptube. This motion limit is essential because it prevents damage to control cables, cable stops, and even the front brake. Occasionally a bicycle, due to high handlebars and/or low toptube, does not have this built in motion limit. The hand formed steering limit takes the place of the front cable hanger under the headset top nut. Two rubber pads on the backside of the arms contact the toptube to limit steering motion to about 180 degrees. This polished high grade aluminum part is offered only to

FIG 14

owners of Cunningham bicycles who need a steering limit. They are handmade in small quantities and are formed specifically to fit Cunningham bicycles. $94.50

CONTOURED STAINLESS WASHER FOR CUSTOM SEATPOST QUICK RELEASE (FIG 15)

FIG 15

This hardened curved washer is an improvement which replaces the flat washer that goes between the cam lever and the collar. The new design makes the quick release work smoother and better. All new bikes come with the new washer. They are available for pre 1989 Cunningham bikes. $3.00

YOUR NAME ENGRAVED ON THE NON-DRIVE SIDE CHAINSTAY

Last month, Alice B. Toeclips got the notion that her bike would be more "thief proof" with her name ground into the chainstay. I complied, and the results were overwhelmingly positive: the bike is now worth twice as much and requires *two* Kryptonite locks. I can personalize your bike by writing your name in the thick aluminum with a small ball dental burr. The effect is very nice but can't be erased, so be sure that you will not be trying to sell the bike someday. $85. (For high-status pseudonames like "Jacques Anquetil" there's a poseur tax.)

WTB BRAKE BRIDGE

This aluminum hoop shaped device mounts on top of the spring holders to add support to the brake mounting. Cunningham frames and forks already have unusually rigid brake mountings but this bridge adds yet more stiffness to the system. It is recommended on the rear brake when one is using the quick release option or when one wants a little better brake response. I use a one piece brake bridge with no slots or adjustments which is the best possible design, but requires more knowhow and time to instal properly. I prefer to do the mounting of this piece myself because there are subtleties to the installation which would be hard to have others do properly. $55 (includes custom debris deflector and labor)

WTB WIDE FRONT HUBS

I have always used extra wide front hubs on my personal mountain bikes. The advantages are better shock absorbtion (because of the wider angle between left and right spokes) and a more laterally stable wheel with less side to side deflection. The better spoke bracing angle allows the wheel to hold its trueness with fewer spokes. The fork is built with 12.5mm wider dropout spacing (115 total) to accept the wide hub.

O.K., fine. Why not? Well, the big drawback is that you have non- standard stuff. You can't just borrow your friend's wheel. The bike needs a special adaptor to go on most racks. Best to consider this one carefully before ordering.

WTB offers a wide front hub that is as wide possible (102mm) while still being able to fit into a standard fork (it only works on TII style

forks). This is the best, short of going non standard. The full-on extra wide (115mm) front hub is also available thru WTB. I can build you an extra wide fork (any type) for an additional $10.

WIDE FORK ADAPTOR

For wide fork people I have a Yakima rack adaptor kit which includes a quick release, two rack axle extender caps, a bushing, and two centering springs. $35

EXTRA WATERBOTTLE MOUNTS

Two water bottle mounts on the upper side of the downtube are standard. I can add one to the under side of the downtube which includes two special standoff bushings that provide clearance for the brake cable. $32.50 Although a water bottle mount can be put on the seattube, the Riv-Nuts extend into the tube preventing pump storage.

CUNNINGHAM MODIFIED SILCA PUMP FOR STORAGE IN YOUR BIG DIAMETER SEATPOST

It is light, reliable and doesn't rattle. $35

TEE-SHIRTS

All are avalable thr Jacquie, @ $13.50, incl shipping. Any four for $45. 100% cotton, natch!

We have a good supply of four different t-shirt designs to get across your fat-tired fun-addict's message:

1) Cunningham Indian Head Motif —A black, short sleeve shirt with turquoise logo, and on the back, the message "My Other Mountain Bike Is A Cunningham" in yellow letters.

2) "Alice B. Toeclips – A Legend In Her Own Mind" A gag shirt with powerful "mojo". Guaranteed to make you or your old man (or lady) go faster up hills. Just add beer and serve. Long-sleeve shirt (no extra charge to you) in white, grey, yellow & teal with pink logo. All sizes, but state second choices in color as there are only a few in teal, for example.

3) "Greetings From Marin County (bicycle heaven) "— A neon-touched postcard motif (large only, & any color, as long as it's white.) Back side of shirt has a postcard message from big mouth Toeclips.

4) WOMBATS — Short-sleeve shirt in blue or pink, all sizes. The furry, friendly mascot of the Women's Mountain Bike And Tea Society emblazoned across your chest will elicit big smiles, especially from good-looking Aussies.

Speaking of WOMBATS: It's easy to join, and for your $25 you get a quarterly newsletter, a shirt and a purple, black and white "WOMBADGE" Write WOMBATS at Box 757 Fairfax CA 94930

WTB NEWSLETTER

It is published quarterly and contains everything from tech opinions to high adventure, to cartoons. Call or write WTB.

USED CUNNINGHAM DEPARTMENT

The custom trials bike which I built for Jim Trigonis for the 1988 season is up for grabs. It is in top condition. (Jim is a smooth rider and took good care of the bike. I have gone over it and repainted the stem , forks and bars and given it a full tune up.) Jim won countless trials events on this bike during 1987. He was the top placed US rider in the NORBA Nationals so the bike has proved its capability. I'm asking $1500 for it. (Frame no. T1)

Also for sale is one of my personal mountain bikes. It is an Indian with 17.375"CS and 42.5'WB. Has Type II fork, Grease Guard throughout, Cunningham Gooseneck stem, WTB bars, trick prototype shifters, deraillers, etc. Perfect cond. $3800. (Frame #CBC)

THE CUNNINGHAM OFFROAD RACING TEAM

The 1988 Cunningham Offroad Team consisted of Eric Stirling (Vets), Tracy Smith (Pro Am), Terry Griebel (Pro AM), Jim Trigonis (Expert Trials), Janis Coblentz (Vet Women) and the legendary national champion Alice B. Toeclips (Jacquie Phelan) who promotes womens involvement in cycling and manages WOMBATS (Womens Mountain Bike and Tea Society). We gratefully received equipment sponsorship from Shimano and Specialized with Puma supplying clothing and shoes.

The season was characterized by top placings and wins by all of the riders. In the NORBA National Trials Championship, young Jim Trigonis showed he was the best U.S. trials rider on his special Cunningham bike, getting a close third behind world champion Ott Pi of Spain and Hans Jorg Rey of Switzerland.

Each rider is a valued friend and representative of Cunningham bicycles. Their experiences in the widely varying conditions of the offroad racing circuit provide information which is useful for the continuing evaluation and improvement of the bike and components.

The offroad racing scene is changing rapidly and becoming more professional. More is at stake financially for the big sponsors and as a consequence the atmosphere at the events is more serious. In the early years of mountain bike racing the top riders went where the best bikes were; they now go to where the best contract (and the most money) is. Nowadays the top racers frequently are found to be riding bicyles that were not even built by their sponsor.

Not withstanding, the Cunningham Offroad Team will continue because constant testing in the racing context insures that the bikes will perform perfectly under all conditions and meet current needs. Also, our racers use the latest equipment, allowing riders in other areas of the country to see the bikes and learn about our high-tech componentry from well-informed users.

POLITICS

I can think of few things more odious than politics. But we, as users of mountain bikes and appreciators of the experience, find ourselves with the unexpected responsibility of trying to share the value of what we have discovered to those who don't understand and feel threatened.

When I used to ride single track trails in the middle of nowhere, I began to know something... if not consciously. Now, as this experience which seems so right is being challenged, I am beginning to understand it better.

For all but our most recent past, human survival has depended on the development and effective use of skills like depth perception, timing, balance, co-ordination, and judgement. These skills were developed and used in natural surroundings. As human beings, we inherit from our ancient past a basic and powerful need to develop and express such skills in a primitive natural environment .

Outdoor sports answer these needs to some degree in developed countries. What has been missing is a way to connect that experience to our technical world of cars, supermarkets and tract homes. Today, the mountain bike is emerging as a unique way to integrate the two seemingly irreconciliable realities.

Growing numbers of people are being attracted to the mountain bike for reasons relevant to the living conditions found in overdeveloped countries which suffer from unwise use of technology.

The mountain bike is a friendly, sustainable, nonviolent technology. It is being discovered as a new way to regain essential contact with nature. To ride a mountain bike in natural surroundings is to discover lost freedom and sensory familiarity. Mountainbiking offers a unique chemistry which combines expression of primal human needs in nature, with a technology which is useful in everyday life. Even while riding in a city, one becomes more aware of the lay of the land, the weather and the seasons.

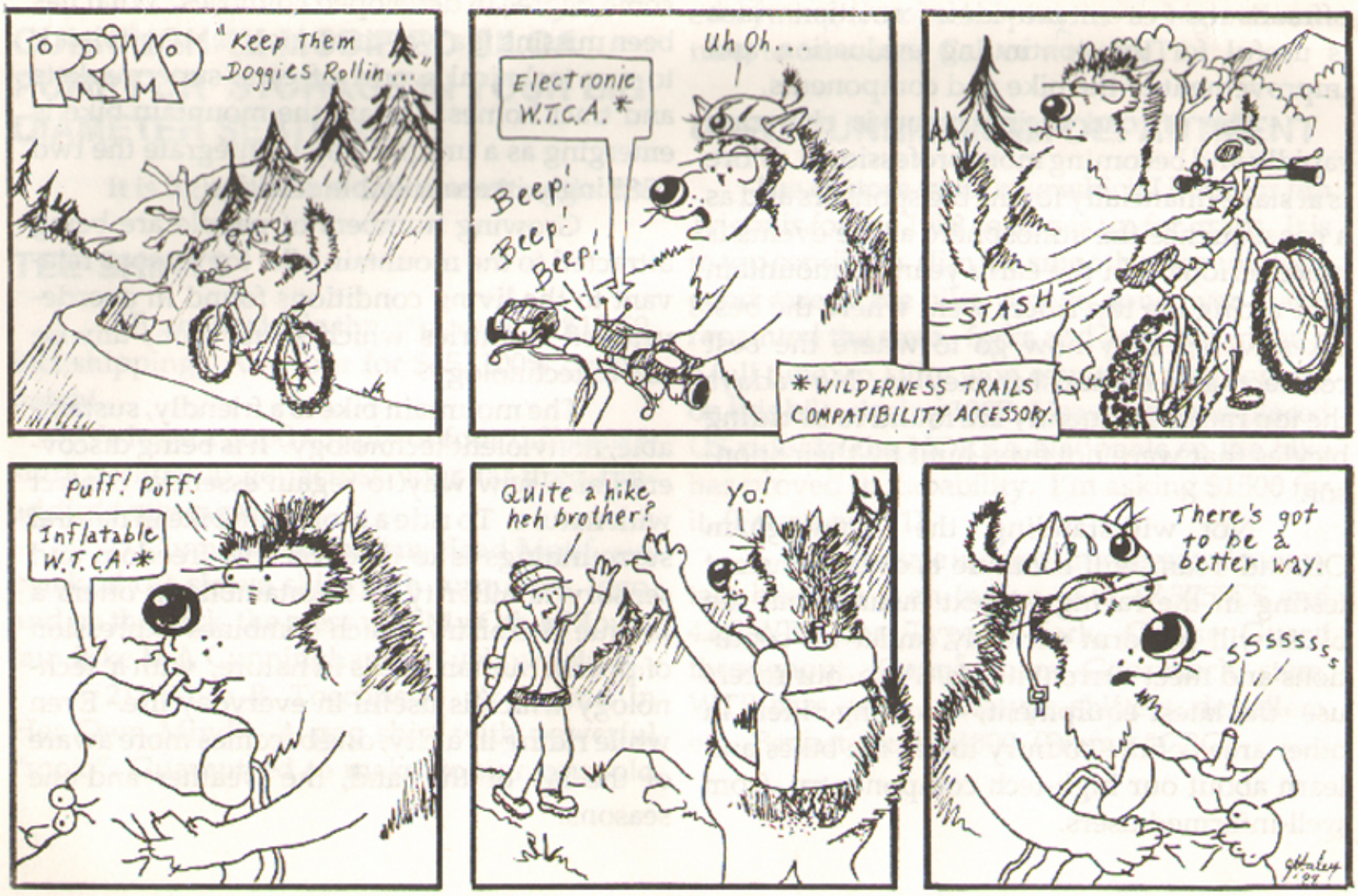
Unlike the users of motor vehicles, the mountain biker forms a personal alliance with the land. Every rise and dip of the terrain, every change in surface has a direct effect on the breathing and circulation. Many subtle and good things begin to happen to a person who uses a bicycle in natural surroundings. The more one rides a bike under these conditions, the more one will develop new sympathy toward nature and greater understanding of the ecology of our planet. Ever notice how people riding mountain bikes smile a lot? These people are celebrating !

Mountain bikes are an important part of a widespread social awakening that is taking place right now. The phenomenon is epecially attractive to young people because it offers contact with nature and represents hope for the future. The mountain bike is a perfect tool for right living. I think that this is why it captures the keen intrest of so many people today.

The experience should be encouraged in its fullness, and made available to as many people as possible, not forbidden as some of our less visionary land guardians would have it.

The Sierra Club, which is supposedly committed to the preservation of life on Earth, is demonstrating lack of wisdom and perspective with their current position on mountain bikes. Perhaps a broader, global view of the situation is needed. What are the *real threats* to the life of our world today? Most will agree that human thinking and attitudes are at the source of every trouble.

Will discouraging the use of mountain bikes in wilderness help protect life? Or is it possible that encouraging their use will help bring the changes in attunement and in turn values that must happen on a large scale before the life threatening trends can be reversed?



C H A R L I E C U N N I N G H A M

PERSONAL STATISTICS

Name: Charlie Cunningham
Birthdate: 8/23/48
Birthplace: Washington, D.C.

Location: Point Reyes Bikes
11431 Highway 1
Point Reyes, CA 94956
Cunningham Applied Technology is my custom bicycle business. Wilderness Trail Bikes is the bicycle component business, shared with Steve Potts and Mark Slate, 134 Redwood Ave., Corte Madera, CA

Awards/Articles: Founding Member of Fat Tire Hall of Fame and Museum (inducted in 1988). Bike Tech—testing frame material, Technical writer for Wilderness Trail Bikes

Personal Statement: The mountain bike is a new resource that will soon prove its value on a global scale. It will come to be known as a sane, friendly technology bringing solutions to the world pollution and transportation problems while helping to heal humanity through contact with nature.

BIKE SPECIFICATIONS

Name: "Charlie Cunningham Indian"
Weight: 25½ lbs.
Size: (Center to top) 21"
Wheel base: 41⅜"
Standover Height: 30"
Top Tube Length: approx. 22"
Head Angle & Seat Angle: 71°/71.5°
Fork Rate: 1.875"
BB Height: 11.8"
Chainstay Length: 16.875"
Frame Materials: Heat Treated 6061-T6 Aluminum
Derailleurs: Modified Shimano front, Suntour rear
Wheel Size: 26"

Comments: This bike is built with clearance for the revolutionary new specialized 2.5" Extreme Tires designed by Wilderness Trail Bikes