

THE 400-4 FILES

Volume 3, Issue 1

July 2009



In This Issue

The400Store
Street Specials

Rake & Trail
What it is, what it
does

Chassis building
part III



Features

- 8 – **Sleepless in Seattle**
We take a look behind the scenes at The400FourStore with Kevin Mullin, and his 400F street specials
- 12 - **Build a bike from scratch.**
Part 3 The last in this series of frame building basics.

Technical

- 4- **Rake & Trail**
We'll put some to sleep with this subject, but hopefully there are some out there who will think about this the next time they slap on some aftermarket tires or shocks on their 400F

Regulars

- 3 **News**
- 3 **Editors Comment**
- 7 **For Sale**



Tasty goods available from The400FourStore

Editor's Comments

Well, this is the third issue of The-400-4-Files, and again 2 years have passed between issues. How time flies. Work, work, and work, the three things that get in the way of doing the important things in life. I spend the entire day in front of a CAD screen doing machine design, and it seems like when I get done my days' work the last thing I feel like doing is sitting down in front of my computer and doing more work. So for the last couple of years I have been neglecting my bike design, my website, and this newsletter.

But lately I've been forcing myself to devote more time working towards finishing my various projects. With that in mind, I invite everyone to visit my re-launched website, www.denoonsp.com. I have taken over the web design from my girlfriend, and while she did a great job on the site, I hated bothering her to do updates and keep it current, so hopefully this will mean the site will get updated more often. I recently found some WYSIWYG software that allows me to easily work on the site without learning html. I invite you to keep checking the site, I promise to get it updated as soon as I can.

Summer has finally arrived here in Winnipeg after a long cold spring, so by rights I should have the CBR400F on the road. But along with the late summer there have been other forces conspiring to keep me off the road.

I've got a case of the dreaded weeping head gasket that started last summer, and even though I know changing the head gasket and the o-rings in the head is only an afternoon job, I still keep managing to put it off every weekend.

The other problem is the cost of insurance. I live in a part of Canada that forces you to buy public insurance. In theory it should be a good thing because it eliminates people suing each other over accidents, and there are no uninsured drivers because you have to buy the insurance to get a plate.

But, like all things run by the government, the system has become bloated, inefficient, and run by bureaucrats who have no reason to listen to their customers. Since 2005 the cost to insure my 400F has doubled from about \$550 to \$1100. And that is basic collision, with a replacement value of less than \$1000, and a \$500 deductible. It is ridiculous, as in the province next to us the same bike is only \$186 for the same coverage. The government's response is that for those riding a

motorcycle, it is not a question of if you fall down, but when, and the rates reflect the cost of insurance against lost wages and medical bills, (even though we have free medical coverage in Canada).

Bottom line though, for the lack of interesting roads, and the short riding season (7 months if you push it), it is just becoming a real issue as to the worth of riding on the street.

We do have a local racetrack about an hour away, and while they don't offer any vintage racing, they do offer track days on every race weekend for about \$100, and that is looking more and more attractive.

Comments are appreciated at rdenoon@mts.net

Keep Riding

News

MotoRetro Illustrated - Relaunch

Rick Denoon

After too few great issues, Motorcyclist Retro was axed by the parent publishing company, not because of lack of interest, but because they just deemed it to risky in today's down economy. But editor Mitch Boehm believed in the concept enough to publish the magazine by himself, and the result is MotoRetro Illustrated. The magazine will focus on the types of bikes that we love, and deserves our support. For more info, go to;

<http://www.motoretroillustrated.com>

Hot New Links

Here are some new or CB400F specific links that I have come across.

www.400fourstore.com/index.

www.ttr400.com/

<http://oldmanhonda.com/MC/wiring350F.html>

<http://www.cb400f.btinternet.co.uk/index.htm>

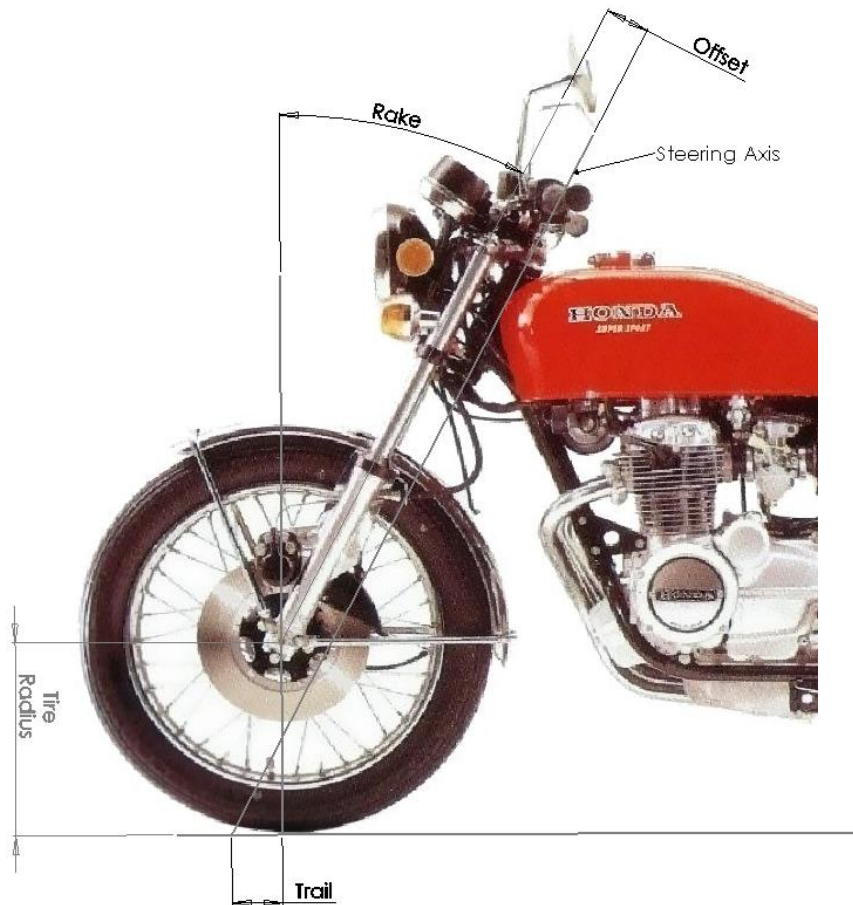
<http://home.comcast.net/~eyhonda/home.htm>

<http://www.sohc4.net/>

<http://users.fulladsl.be/spb2854/index.htm>

<http://cafe400f.cloud.prohosting.com/>

<http://www.teamhansenhonda.com/hailproj.htm>



Rake & Trail

There are many factors that can be discussed when trying to understand rake & trail, stuff that you normally don't hear about such as "real trail" vs. "ground trail", and "rear wheel" trail. I'll break this article into two sections, the first where I'll give a brief explanation of the terms, and how they apply specifically to the CB400F, and then a second section where we will explore the more technical aspects, and try to understand just why these two factors influence the handling and "feel" of a motorcycle.

Part 1

Trail – We'll look at trail first because even though it is much harder to understand, much less see, it is arguably the most important number in chassis design. Trail can be defined as the distance between the point where a line extending down from the steering axis intersects the ground and a line extending vertically from the axle intersects the ground. Later, in part 2 this will be further defined as "ground trail"

Rake – Rake can be defined as a measurement, in degrees of the steering head usually from the

Everyone has seen "Rake & Trail" figures quoted in magazines, brochures, and shop manuals, but what is it, and how does it relate to motorcycles.

vertical. I say usually because you will sometimes see this measurement given from the horizontal axis.

CB400F – The 400F used rake/trail/and wheelbase numbers that were not seen before or after: 26.5 degree rake, 85mm tail, and a short 53.5" wheelbase. The CB400T that replaced it used much more conventional 27 deg rake, 100mm trail and 55" wheelbase. So how does this all relate to the CB400F? Well, any change that you make to one area of the bike, chassis wise, is going to affect the rake and trail. Putting on a taller rear tire, or longer than stock shocks? It's going to reduce the rake and trail.

Conversely, adding a taller than stock front tire, or shorter than stock shocks will increase the rake and trail numbers. Changing the 18" wire wheels for modern 17" mag wheels, and modern forks using triple clamps off of another bike could really leave you in no-mans land. Maybe the easiest thing to do is look at a chart that lists some of the changes that any owner might do in the course of just maintaining his or her 400F, and see what the resultant effects are.

	Rake	Trail	Front tire	Radius MM	Rear Tire	Radius MM	Shock length MM	Clamp Offset
Stock CB400F	26.5 deg	85mm	3.00 x 18	305	3.50 x 18	317.5	324	60mm
Test 1 - new tires	27 deg	95mm	90/90	318.6	100/90	318.6	324	60mm
Test 2 - New 13" shocks	26.1 deg	82.8mm	3.00 x 18	305	3.50 x 18	317.5	330	60mm
Test 3 - CB550 clamps,new tires,13.25" shocks	26.6 deg	106mm	90/90	318.6	100/90	318.6	336	48mm
Test 4 - Stock, fork tubes raised 3mm	26.3 deg	84mm	3.00 x 18	305	3.50 x 18	317.5	324	60mm
Test 5 - 48mm clamp offset	26.7 deg	99.4mm	3.00 x 18	305	3.50 x 18	317.5	324	48mm

Chart 1

I have tried to show some typical scenarios that the average 400F owner might encounter, so let's take a closer look and analyse the changes and the resultant changes to rake and trail. (See Chart 1)

Row 1 shows the stock CB400F, stock tires, stock 12.75in (324mm)shocks, and stock triple clamp offset of 60mm

Test 1 shows a typical owner replacing his tires. Tires are generally not available in the stock sizes any more, so I substituted sizes that are readily available, and commonly used on the 400F. The 90/90 is taller than the stock 3.0" front tire, and you see a resultant ½ degree change in the rake, and a rather large 10mm increase in the trail.

Test 2 shows someone replacing the standard 12.75" shocks with more commonly available 13.0" (330mm) shocks. You see the higher ride height decreases the rake by .4 degree, and decreases the trail by 2.2mm

Test 3 shows someone changing over to CB550 clamps, maybe to do a dual disk conversion, and in an attempt to get the trail back closer to stock, I substituted 13.25" (336mm) shocks. With the longer shocks we get the rake angle back close to stock, but the trail is significantly greater, at 106mm.

Test 4 I raised the fork tubes by 3mm in the clamps and we see a 0.2 degree decrease in rake, and a 1mm decrease in the trail.

Test 5 shows CB550 clamps with no other changes, we get a 0.2 increase in rake, and a 9.4mm increase in trail.

What statements can we make from looking at the chart?

- Raising or lowering the fork tubes 3mm will result in a 0.2 degree/1mm rake/trail change
- Every ¼" increase in the shock length results in a 0.4 degree/2.2 change in rake/trail.
- For every 1mm change in clamp offset, we will see a .01666 degree rake change, and a .783mm trail change.

These statements will only be true for the CB400F, or a bike with the same wheelbase.

Part 2

For those whose eyes have glazed over already, you might as well stop reading now. If you are still with me, then read on.

We can expound on our analysis of trail and introduce a second type of trail, which we will call "real trail", and a third type we will call "rear wheel trail".

The primary function of trail is to introduce a certain amount of self centering steering stability. Looking at Figure 1 we can see that the contact point of both the front and the rear tire are behind the point where the steering axis meets it. This leads to a self centering effect that can best be seen in Figure 2. Real trail, or

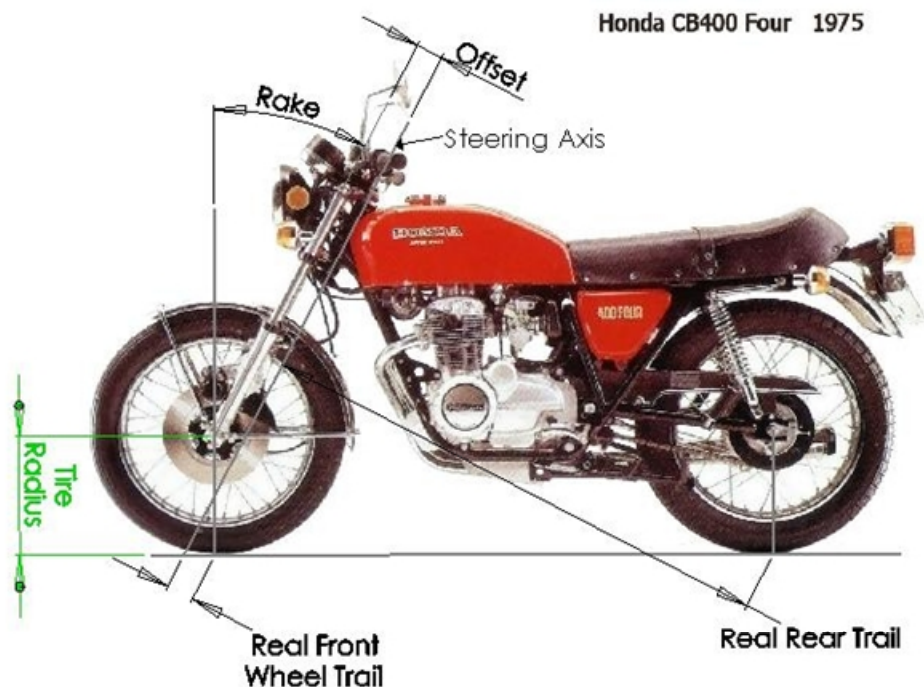


Fig 1 – Real or mechanical trail is measured at right angles to the steering axis.

Compare this with the ground trail as shown in the photo on page 4

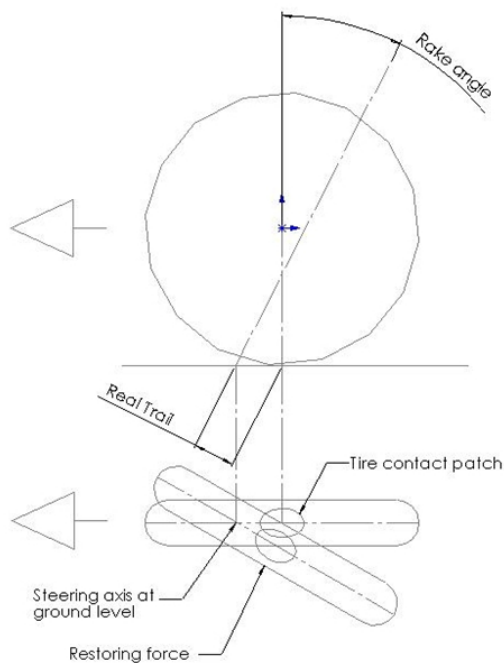


Fig 2

mechanical trail is measured at right angles to the steering axis, and this would be the logical distance to use because it is this distance that creates a torque about the steering axis from any forces at the tire. Despite this fact, it is the ground trail and not the real trail that is commonly listed.

Referencing Fig 1, you might think that the rear trail would have a greater centering effect than the front. The reason that this is not so is because if the rear wheel gets out of line with the direction of travel by say 1", the angle relative to the direction of travel will be fairly minor, perhaps $\frac{1}{2}$ - 1 degree. This small angle generates an equally small centering force, and this force is acting against the inertia of a major portion of the machine and rider. If the front wheel on the other hand gets out of line with the direction of travel by the same 1", the front wheel will be turned some 10 - 15 degrees, and that will generate a larger sideways force that only has to act against the small steering inertia of the wheel and forks.

The self-centering force can be enough to actually cause the wheel to go over center in the opposite direction. Typically the damping action of the riders' hands and arms on the bars is enough to stop this in one or two cycles, but if the forces are great enough, or if the riders'

hands are not on the bars, the results can be the dreaded tank slapper. This phenomenon can also be experienced on a lot of bikes if the frequency of the oscillation finds a natural harmonic that causes it to build up, instead of dissipate. In a lot of bikes this seems to happen when decelerating in the 30-50 mph range, when the handlebars of otherwise stable bikes will oscillate back and forth until the bike passes through the speed zone in which the harmonic is occurring.

Is Rake Required?

Traditional thinking has long held that 27-28 degrees rake was part of a magic formula to produce stable handling, but over the last 10-15 years we have seen both race bikes and street bikes with rake angles down to as low as 20 degrees, and these bikes are still stable. Hub center steered bikes which have no fork offset are often run with 10-15 degrees of rake and these bikes are often praised for their stable handling. So where do we get the now ubiquitous rake numbers of 25-30 degrees, and why are steeper rake angles becoming more common?

The main reason is likely ease of design and manufacture. Raking back the steering head at an angle of 20-30 degrees leaves room under the steering head for the front wheel to move under fork compression without interfering with the exhaust pipes. Rake angles are getting steeper because stiffer frames and forks allow it. If you imagine the forces of a braking bike acting on the front wheel of the bike, the forces have more of a bending moment acting on the forks as the rake gets steeper. The flimsy forks and frames of the 70's and 80's would chatter if built with the steeper rakes of today. The trend of pushing the center of gravity and hence the engine farther and farther forward to counteract the affects of increasing horsepower and rapid acceleration has demanded that designers minimize the distance from the front axle to the engine, as happens when the steering head is steepened.

So, understand that any changes you make to the wheels, tires, shocks, forks, or triple clamps are going to have an effect to the rake and trail, and as a result, the handling and feel of your bike. Some of these affects can be countered with a corresponding change to another area. Do your calculations first, and take notes as you make changes, you may find that you like the handling with rake and trail that is different than stock.

Stock Clearance

I have two sets of front engine mounts that I built and had anodized with some other parts one time. The material I used has some blemishes (nicks and scratches) so they are not perfect. I also ran out of hardware so they would be sold without hardware. \$20 a set.



I also have 4 rear engine mounts, each complete with hardware. These have mounting provisions for the stock air box. I only have one of each style available. \$75, any style.



Style 1

Style 2



Style 3

Style 4

Differences are the details of the pocket machining, and some are thinner material with thicker spacers, and some are thicker material with thinner spacers. If anyone wants more information, contact rdenoon@mts.net

Sleepless in Seattle?



What is now called The400FourStore was once known as Eaglescall.com. Anyone who does any research at all on the web for 400F parts eventually ends up at the site. Kevin Mullin has been providing the 400F community with trick and rare parts for their bikes for quite a while now, and I thought it was time to get to know him a little better.

Where it all began.....

Growing up in Seattle, Kevin's bedroom window overlooked the I-5 freeway, the busiest interstate on the west coast. He lived about a mile from the University of Washington, so there was always something going on.

He was ten years old in 1975 when the CB400Four hit the streets, their haunting sound hung in the summer air as they screamed down the freeway in the middle of the night, "I could always tell when it was a CB400F, it had the sweetest sounding exhaust I had ever heard". Kevin was very familiar with the sound of the 400F, thanks to a completely spoiled neighbor kid, who had a complete, street legal, Kaz Yoshima CB400F, "and the freeway behind my backyard seemed to be his favorite place to push the redline. Oh how I loved to hear that bike coming!"

When friends stayed over on the weekend's they would stay up all night playing "Guess the car (or bike)" just by the sound of the engine. Kevin had an unfair advantage having always lived in the house above the freeway. But the one engine he didn't need an advantage with was the CB400F, even the untrained ear could pick that sound out.

After school he would always stop by the local

motorcycle shop, University Honda, AKA Seattle Honda, the first Honda dealership in the United States. He would drool for hours on the XR75 and the CB400's. "My walls were plastered with brochures, if only I had kept them. I am sure they spent a lot of time wiping down the bikes after I left. I still do business with them."

"My parents were pretty reasonable, thanks to my older brother and sisters who broke them in by breaking all the rules. Their philosophy was that we could have anything we wanted, as long as we paid for it. However, a motorcycle somehow was not on that program, and they weren't giving in."

When he was twelve years old Kevin had an idea, he asked his mother "If I were to build a mini bike would I be able to keep it?" She finally agreed, only to regret it later. With help from friends, his metal shop teacher, and the donation of a neighbor's roto-tiller, a two wheeler was born.

Weekends were spent riding in the country at dad's cabinet shop, and every chance he got, in the alleys of Seattle, the police were making regular visits to see the parents. "I finally saved enough money from my paper route for a Suzuki DS 80, and managed to get into even more trouble with that."



The business end, a handbuilt Kaz Yoshima race pipe. The sound emitted from this hole has been described as “Ungodly Loud”

“In 1981 I was 16 years old and had a driver’s license. I wanted a real motorcycle. I found a lightly wrecked ’78 GS 750 that was really hopped up. I thought it was a good deal for \$400.00 so I bought it. It turned out to be not such a great deal by the time I was done putting it back together, but it was a learning experience.”

Now, to put this in perspective, at the age of 16, Kevin was 4’9” tall and weighed 75 pounds...for someone of that stature, the bike was a beast! “I took the motorcycle driving endorsement test on the 750 so I could have a class 3 endorsement. This was back when you could not take the test on a 125cc bike and legally be riding a Harley the next day.” The Washington State Patrol officers were in shock when Kevin rolled in on his 750, but, he was the only person that day who received a 100% grade.

“I would ride the beast to school every day and even give rides to my friends, they were either fearless or extremely stupid, I like to think they were fearless.”

One of Kevin’s friends had a CB400Four that he loved to ride, it fit him much better than the beast, and the beast was a better fit for his friend. They would have traded for keeps if it had not been for the dreaded broken kickstand syndrome on the CB400F. “I was not able to put it on the centerstand by myself and it embarrassed me to no end to have to have him help me.”

Later that year the 750 was sold, replaced by a CB400F of his own, complete with highway pegs, faring, luggage rack, sissy bar, and a trunk. “I bought it from the original owner with 7,000 miles on it for \$550.00. I still own this bike. Around here we refer to her as the “Hanger Queen”. Today she has 13,000 miles on her.”

In 2000, after kicking the idea around amongst his friends, Kevin decided to look into having a mold made for CB400F side covers. After meeting with several different companies who educated him on vacuum molds, injection molds, and every other type of molding process there was, he decided



that vacuum molding was the right way to go. It took a few try's to get the mold exact, but he accomplished it. The first batch of twenty sets went straight to a paint shop. "I wanted these to be perfect for my customers. If you ever want to really screw up a schedule, have someone paint something for you." After spending way too much money on color matching, they were finally painted Ruby Red or Black.

"I finally got the side covers back from the painter and started listing them on eBay. I sold a few sets here and there, but found that the work involved was much more than I anticipated. I made a friend through eBay, David Aldrich, who also lived in the Seattle area and owned a CB400F. David is a motorcycle nut like me so we hit it off right away. David had experience building websites and offered to put up a page for the sidecovers. All I had to provide was the domain. My older brother, Russ, had a domain that he was basically using as his personal email server, Eaglescall, so he said we could test out the site there."

But Kevin wanted to do more than just sell sidecovers, he wanted to provide information about the bikes he loved. David was very creative, and came up with more articles to add to the site, and even a few more products to benefit the CB400 community.

"I made another friend, George Maki. George's wife, Misato, is Japanese. Both George and Misato are bike nuts too." George lives in Washington and was putting together a very trick CB400, using parts from Japan never available in the USA. George had made a business connection with the folks from MC-Again of Japan.

"I was in awe the first time I saw that beautiful Plot oil cooler and those MC Again rearsets. George liked the idea of offering these products to the rest of the world so we added them to Eaglescall. "

It wasn't too long after that, that Kevin made another new friend, Kevin Bidgood. Kevin lives in South Africa and is very serious about his 400 four's. Kevin Bidgood had already manufactured some very cool stuff for his CB400F race bike, and was interested in some of the Japanese products and some stuff from the USA that he was having a tough time obtaining. They started talking regularly, "I had a few ideas of my own for some cool stuff I that I wanted for my bikes. We decided to import some of the products and make them available to the rest of the world."

"I really love these little bikes, they bring back fond memories of my youth. I hope that I remain fortunate



enough to always have one in the garage. Eaglescall isn't a business it's a hobby. I haven't (and never will) made any money with it, but it is cheaper than therapy. Sanity comes with a price and while doing something I like to do, I have made friendships with people whom I have great respect for from all corners of the world."

"I want to thank the people in the CB400f community for taking the time to read this, and Rick, Jeff, Eric, and Aaron who dedicate a lot of their time to helping anybody out there with a question about the little four. I also want to thank David, George, Kevin, and my brother Russ for all the effort they have put in behind the scenes at Eaglescall."

Best Regards,
Kevin Mullin

Kevin's Café' Racer Build Sheet

Motor

458cc Yoshimura pistons w 10.5:1 compression, ceramic coated tops, skirts, underside, and wristpins. Balanced. Carillo "H" beam connecting rods.

A.P.E lightened and balanced crankshaft, and rotor.

A.P.E. precision bored and honed cylinders.

TT Racing stainless steel valves, .75 mm oversize intake

TT Racing titanium valve spring retainers

TT Racing bronze alloy valve guides

TT Racing polished and ported head

TT Racing aluminum cam chain tensioner

TT Racing high volume oil pump

TT Racing slotted cam sprocket

D.I.D. heavy-duty cam chain

Kibblewhite valve springs

Keihin 26 mm CR carbs

Kaz Yoshima header (waiting for powder coating)

KSM oil cooler kit

Webcam Camshaft

Drive train

TT Racing undercut transmission gears

TT Racing bushed shifter forks

Barnett clutch kit

Sprocket Specialties 520 sprockets 16 front / 38 rear

EK Quadra X ring 520 chain – red

TT Racing stainless steel sprocket drive studs

Frame

Frame stiffening support bars added, centerstand and stock exhaust hanger bracket removed. Tank locator dowels removed and relocate kit installed.

TT Racing box swing arm with roller bearings.

Progressive rear shocks

S&W Progressively wound front springs

TT Racing adjustable preload adjusters

TT Racing billet triple trees

All Balls tapered steering head bearings

Wheels

Powder coated hubs

All Balls wheel bearings

O.E.M. bearing retainers

Sun Aluminum rims WM 2 front / WM3 rear – anodized black

Buchanan 8 gauge stainless spokes - polished

TT Racing stainless axles

TT Racing billet wheel spacers

TT Racing billet wheel spacers

Avon Super Venom tires

Ergonomics

TT Racing rearsets

MC Again quick throttle kit

Pro Flo clip-on's w/ TT Racing carbon fiber tubes

CRG Hindsight LS bar end mirrors

Bodywork

Carbon fiber side covers

Carbon fiber front fender

Carbon fiber ducktail (in progress)

Stock tank modified to fit CR carbs, Pingel petcock

Custom paint by Custom Classic Paintworks

Eye Candy

TT Racing engraved points and generator covers

TT Racing billet tappet covers

TT Racing billet oil filler plug

TT Racing billet oil drain plug

TT Racing billet headlamp mounts

TT Racing billet yoke stem nut

TT Racing billet motor mounts

TT Racing billet exhaust mounting collars

TT Racing billet rocker shaft end bolts

TT Racing billet kick starter blanking plug

TT Racing billet rearset mounting nuts

TT Racing aluminum chain guard

TT Racing billet brake torque arm

TT Racing billet brake reservoir cap

TT Racing billet paddock stand bobbins

Nickel-plated hardware

Chrome meter covers

Electrical

MC Again wire harness

Oregon Motorcycle Works solid-state voltage regulator

Dyna 3 ohm coils

Dyna S ignition

Taylor 8mm plug wires

Brakes

Vesrah shoes and pads

Drilled front rotor

H.E.L. Steel braided brake line

Speed Bleeder

In the third , and final installment in this series, we'll have a look at the actual construction of a custom frame for the CB400F.

Unfortunately, I didn't take a lot of photos during this part of the construction, so I have a limited selection to choose from. Where I don't have pictures I'll substitute CAD drawings for reference.

On with it then. I thought the best way to actually weld the frame together was to break it down into small subassemblies where practical. This would make for better control over critical part placements, and hopefully limit weld distortion

First up was the left rear frame weldment (Fig 3). I made the jig up before hand by welding some angle onto a piece of C channel, and then milling the surfaces flat and drilling all the locating holes on the mill. Now when all the critical parts were bolted in place I could be sure that they were located in all 3 orientations, and that they were square to each other. I tacked all the pieces in place, and moved on.

The right side rear weldment was done the same as the left side, and when I made the jig I made it so that it handled both weldments (Fig 4)

Next up for a subweldment was the front cradle. For this the jig was nothing more than a flat plate, a machinist's angle, and a machined block of aluminum with some tapped holes to locate the critical attachment points. The rest of the tubes were held with welding magnets and tacked together. (Fig 5)

The two tacked rear side sub assemblies were then moved to the main weld jig. (Fig 6), and from there the backbone and steering head are added and tacked on. (Fig 7)

I mounted the actual frame jig onto an engine stand, and with everything tacked in place I was able to start welding, and with the engine stand I could rotate the entire frame almost fully upside down either direction to better access the underside welds. (Fig 8 and Fig 9)

Finally, a finished frame! Fig 10

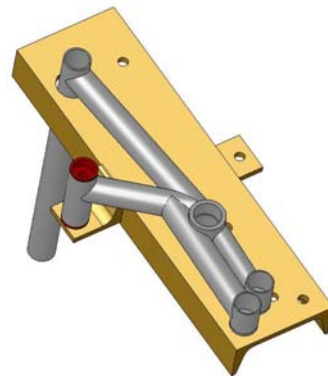


Fig 3
Left side sub weldment on small jig

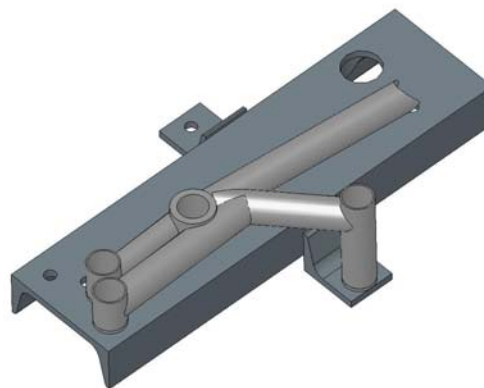


Fig 4
Right side sub weldment on small jig

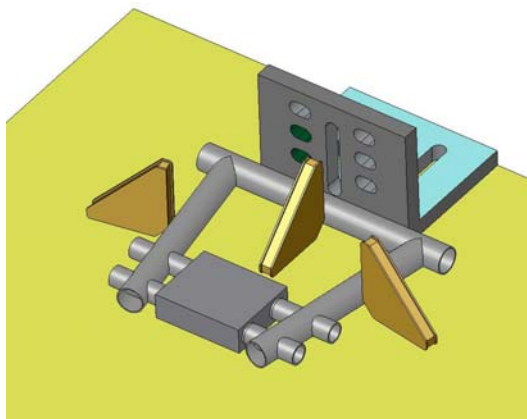


Fig 5
Right side sub weldment on small jig

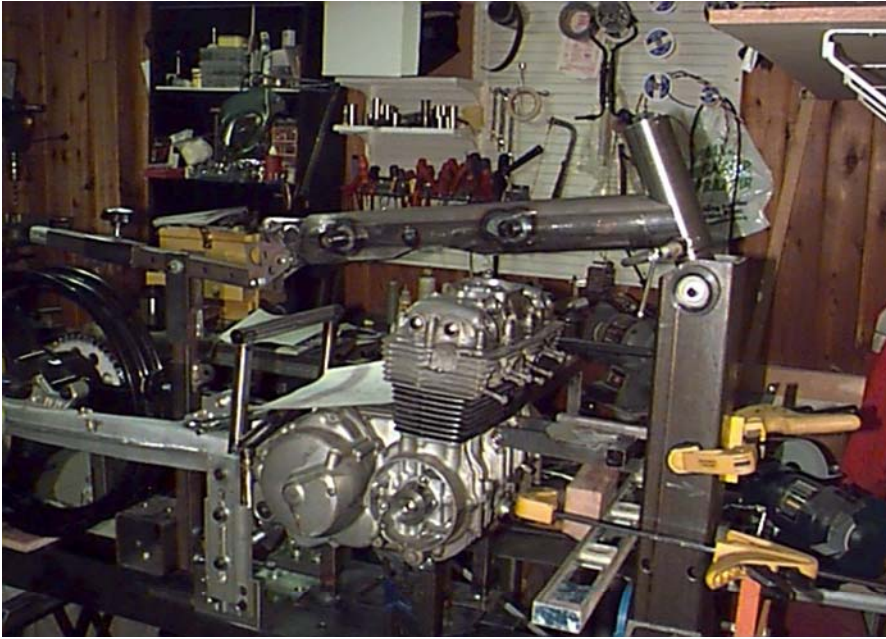


Fig 7
Side weldments, backbone, and steering head

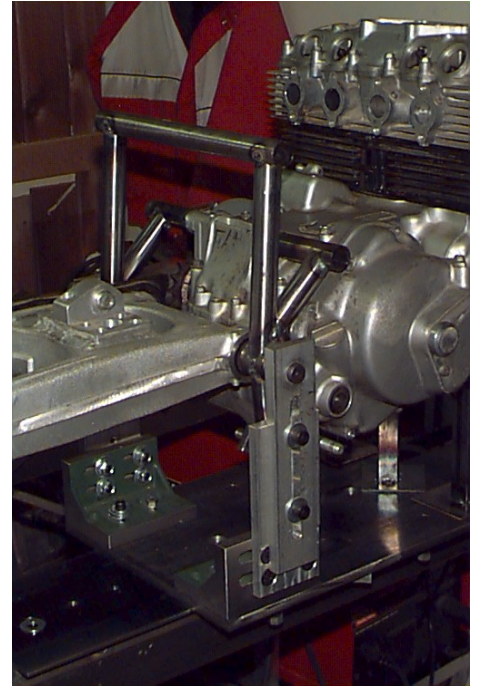


Fig 6
Two halves on main jig

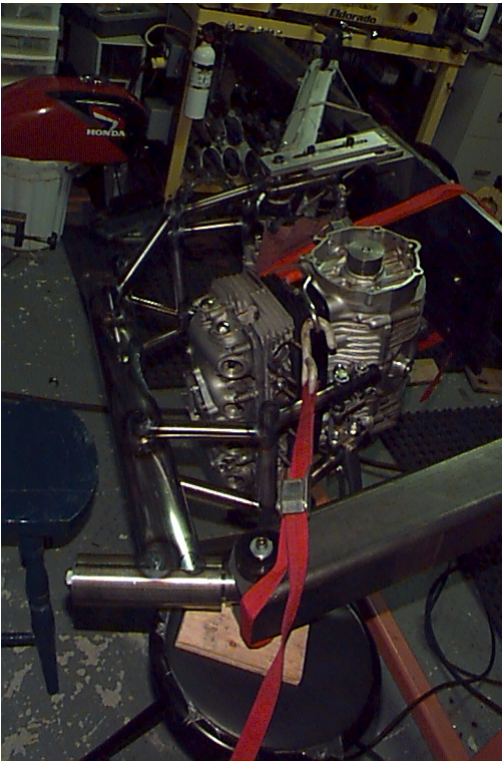


Fig 8

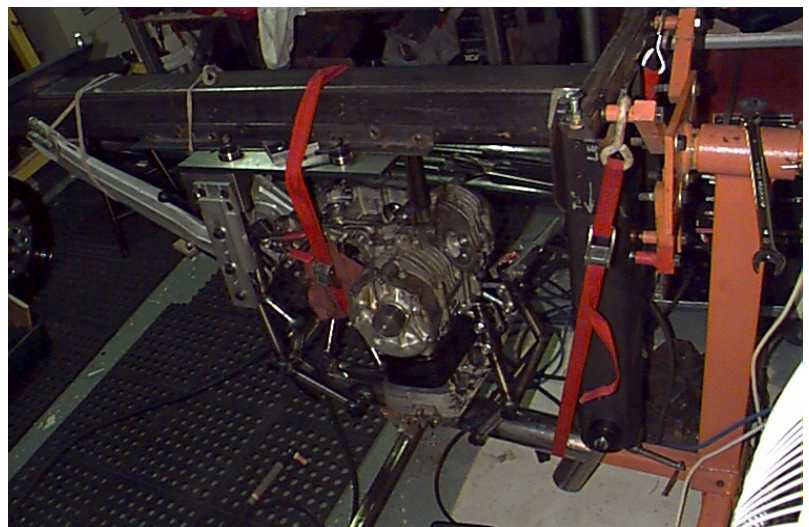


Fig 9



Fig 10