PROJECT SUZUKI PART ONE

This month Cycle Guide explores how the Cheney / Suzuki was built; next month we'll explore how it works.

by Barry Watkins

Ask the average motocross rider which bike he'd race if he could have anything he wanted. He'll probably tell you he'd take a Suzuki works bike. Why? Because that's what has been winning motocross world championships.

Naturally, Suzuki doesn't sell those factory racers through their dealer network. But because of the way the bikes were developed, you can build a very close copy of one, mostly by bolting together parts available from specialty manufacturers. This article tells you how to do that.

The reason you can come close to duplicating the Suzuki grand prix bike is that a specialty frame-manufacturer was involved in developing it. In Japan, the Suzuki racing department had developed a special twin-port engine, and a frame to put it in, and suspension, and the rest of it. Olle Pettersson was racing it in GP events around the world. But the engine didn't have the powerband to be competitive with the works Huskys and CZs and Greeves of 1968. Meanwhile, Suzuki of Great Britain had gotten together with Eric Cheney, who is considered one of the world's geniuses in motorcycle-frame design, engineering, and construction. Cheney had built a motorcycle around the twin-port Suzuki engine, and the finished machine weighed just under 200 pounds. Tom Leadbitter, one of the English motocross aces, rode the bike in local events and won them.

In August 1968, several Suzuki executives from Japan flew to England and had a close look at the Cheney motocrosser. They liked what they saw, and they took the bike back to Japan. The racing department there was equally enthusiastic, and they installed their new single-port 250 GP engine in the frame and shipped the whole thing back to Cheney. Thus was born the successful Suzuki racer.

That 1968 machine was, in many respects, far ahead of everything else being raced at the time. But its biggest advantage was its lightness; the machine weighed just under 190 pounds, dry. (Today, due to a new FIM minimum weight rule passed because the 190-pound racers were dangerously fragile, the Suzukis weigh about 209 pounds—the present FIM minimum.) The single-cylinder 250cc two-stroke engine had magnesium cases. It also had a very-close-ratio four-speed transmission. Ignition was by magneto, rather than CDI. The engine breathed in through a 32 mm Mikuni road-racing carburetor, and it breathed out through a superlight hand-hammered expansion chamber.

The frame had a single front downtube, and cradle rails curving up to the rear of the backbone tube. The fork tubes were hand-made by Cheney, and the sliders were machined from magnesium billets (today they are machined from aluminum billets). The wheel hubs were cast magnesium, and the rear brake was full floating.

The wheelbase was 55½ inches; the seat height was a tall 33 inches; the ground clearance was 8 inches. Nothing could touch the 1968 Suzuki works machine in ease of handling or lightness of weight.

Olle Pettersson rode the bike in 1969, and finished third in the 250cc world-championship standings.

At the end of the 1969 season, Suzuki signed Joel Robert and Sylvain Geboers. They dominated the 1970 250 GP racing season; Robert took all the marbles that year, and in 1971, and in 1972.

Suzuki wanted it all, so they signed Roger DeCoster for 1971, to race/develop their new 370cc machine in the 500 class. DeCoster dutifully raced/developed the 370, and on it he won the 500cc world championship for 1971 and 1972, and just recently clinched his third straight championship.

Since the Suzuki motocross racer was first developed, it has received a steady stream of improvements, but it remains basically the same bike. Because Cheney sells frame kits to the public, I was able to put together a close replica of the Suzuki works bike with surprising ease, using the Cheney frame and a Suzuki TM400 motocross engine. You can do it too. Here's the way you build the works-replica bike.

FRAME AND CHASSIS: In the Suzuki project bike, I used a lot of Cheney components, starting with the frame. Cheney makes his frames from Reynolds 531 tubing, bronze-welded with a 3 percent nickel rod, and plated with a bright-nickel finish. 531 tubing is light, has a high resistance to fatigue, and has a very high tensile strength. However, rather than go ultra-lightweight with the Suzuki motocross frame, Cheney has instead elected to make it one of the ruggedest frames available. The weight of the complete frame with footpegs less swingarm is about 23½ pounds, or about 2½ pounds lighter than a standard 400 Suzuki frame. But there is a tremendous difference in strength and ability to withstand vibration.

The Cheney frame has many ingenious features, and a lot of expensive ones, such as the hollow swingarm pivot-bolt, the use of aircraft-quality bolts and nyloc nuts, the Timken tapered-roller steering-head bearings, the rubber-mounted alloy tank, the high-density seat foam, and the spring-loaded footpegs. The side panels covering the air box are number plates.

The swingarm, a bit heavier than it should be, is predictably sturdy. The rear-axle adjustment is one of the best; elliptical cams with Allen setscrews keep the rear wheel aligned. The shock-absorber mounts at the base of the swingarm are super strong, and the upper mounts on the frame allow the shocks some horizontal movement (as on the works bikes), without danger of breaking the mounts.

Just as Suzuki has made many improvements to their works motocross machines since 1968 as the result of racing experience, so has Cheney made constant improvements to the Suzuki motocrosser frame and chassis kits that he sells to the public. The frame kit that I used consists of the frame, swingarm, footpegs, steering-head bearings, fuel tank, seat, side number-plates, rear fender, and mounting hardware. That kit costs about $600, depending upon the value of the dollar when you read this. The chassis kit includes everything but the engine, and is very expensive. The western distributor for Cheney frames is Knobby Shop International, in San Diego (their address, along with those of the other component suppliers, is listed at the end of this article).

Even though the Cheney swingarm is very rugged, I decided to use a Boyd & Stellings swingarm on the project bike, because it is lighter, and still very strong. The legs of this swingarm are made from 6061 T-6 aluminum; the pieces are heliarced and heat-treated to T6 aircraft specs in a jig. The finished unit weighs about 5¼ pounds, complete with hardware (self-lubricating nylon bearings, pins, chain guide, chain tensioners, and hardware. The price is about $115; for another $25, they will polish the swingarm.

FRONT END: It is rumored that the front forks on the works Suzukis are the best in the world. This is hard to verify, because so few people have ridden those bikes.

Of the front forks available for sale, I think that the Cheney Mk II Superforks


CHAMPION
SUZUKI
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are unbeatable. I have ridden bikes fitted with all of the other great accessory forks, and none of them could compare with the Cheney forks in smoothness and handling. The Superforks are very light, at 17½ pounds for the left and right fork assemblies, the triple clamps, the steering-head stem and hardware, and the alloy axle nut. They are also very expensive, at about $290. But if you plan to duplicate this project bike, and if there is any way you can afford the Cheney forks, I recommend them highly, because they contribute so much to the excellent handling characteristics of the machine.

The fork tubes are manufactured from 1⅜-inch (OD) Reynolds 531 tubing, hand ground and hard chromed. The tensile strength is about 65 tons per square inch. The sliders are machined from solid bars of aluminum alloy; they have a wall-thickness of 5/32-inch, and a tensile strength of 25 tons per square inch. The progressive-type damper assemblies are machined from light alloy. These forks have an overall length of 31 inches from the top of the triple clamp to the axle, and a travel of 6½ inches.

Cheney's triple clamps (part of that $290 ticket for the forks) are specifically designed to give the Suzuki motocrosser frame the right rake and trail with his forks; if you use other triple clamps (and forks), the handling will not be the same. The Cheney clamps are machined so that the fork tubes can't slide up and down; they bottom into the top clamp for extra rigidity. The weight, with stem (which is part of the overall 17½ pounds for the entire fork assembly) is only 4¼ pounds.

If you can't afford to buy the exotic forks, there are several things you can do to improve the Suzuki TM and TS standard forks. Experimenting with lighter oil viscosities to quicken the damping will help them tremendously, as they suffer from slow rebound.

Better yet, remove the damper rods from the forks, and drill a ⅛-inch hole in each rod, just above the other two holes. Replace the stock springs with 33-pound Ceriani springs, and start with 20-weight fork oil. Cole Brothers of North Hollywood, California, sells a kit and instructions for this modification, for about $9.

To protect the forks on the project bike from rock damage, I used Raines Engineering's new universal aluminum fork protectors. They are very light, they snap into place, and they sell for $4.95 through Big Bear Enterprises.

For the front wheel of the super motocrosser, I decided to use a standard Suzuki motocross hub. The complete hub—with backing plate and brake shoes—weighs about 5¾ pounds. This is slightly heavier than some of the other hubs on the market, but the Suzuki has an extremely fine brake.

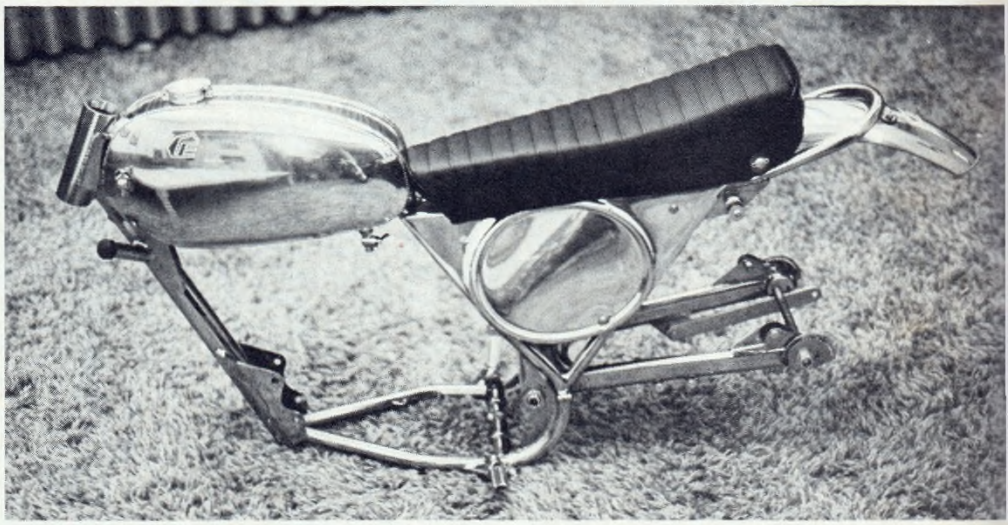
At this point I discovered that my $290 Cheney forks would not anchor the Suzuki backing plate. I had to heliarc the backing plate and then machine a groove in it so that it would fit the anchor tongue on the slider.

If you want the lightest front wheel readily available, you can get a specially-machined Yamaha DT2 hub from Fairway Motorcycles in Placentia, California. This conical hub has a superb brake, weighs 1½ pounds less than the Suzuki hub, and sells for $60.

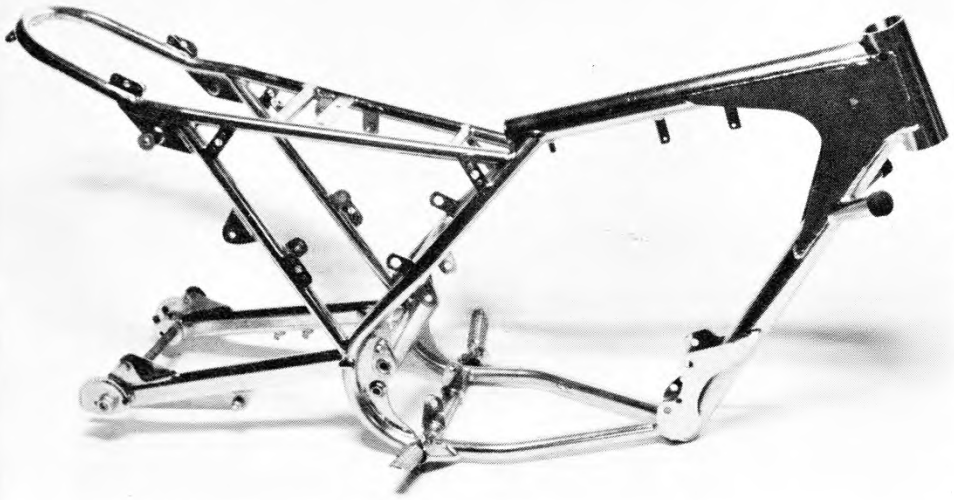
During the past year, DID rims have become popular; they have exceptional strength and don't collect much mud. But they are slightly heavier than Akront rims, which is a disadvantage unless you ride over lots of rocks and need the extra strength.

If you are building up your front wheel, use stainless-steel spokes, because they are stronger than normal ones. And use Buchanan's aluminum nipples for reduced weight.

Trelleborg has recently introduced a



The Cheney-Suzuki frame kit includes the frame and swing arm, footpegs, tank, seat, side number plates (with Dzus fasteners), rear fender, steering head bearings and dust seals, all for $600. The seat was remodeled and another tank substituted.



The Cheney frame features spring-loaded sure-grip footpegs, tubular swingarm bolts, Dzus fastener mounts for seat and number plates, a positive adjustable rear axle, and Reynolds 531 tubing with a nickel-plate finish for easy maintenance.

If good forks allow a rider to ride 5 mph faster than regular forks, then Cheney forks allow him to ride 10 mph faster. The $300 price puts them out of reach of most of us, but they are probably the finest forks you can buy. Front hub is standard Suzuki, rim is DID, front tire a Trelleborg.

two-ply 3.00×21 motocross front tire that only weighs about 7½ pounds. This tire is used on the works bikes; it weighs about two pounds less than the stock front tire. Torsten Hallman Racing in San Diego is the distributor.

The combination of the machined-down DT2 hub, stainless spokes, aluminum nipples, the Akront touring rim, and the Trelleborg tire will weigh 18 pounds, which is 3½ pounds lighter than the stock setup, and one pound lighter than the front wheels on the works Suzukis.

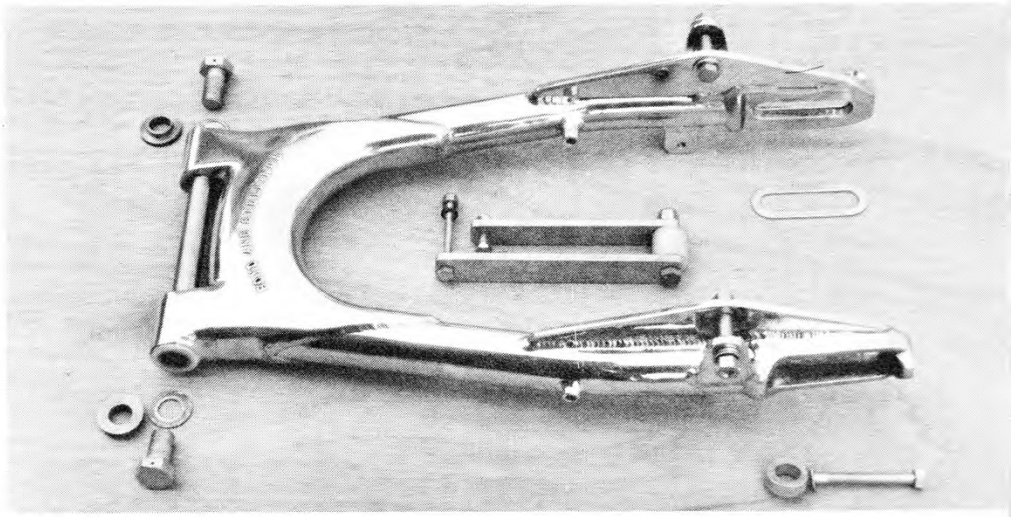
At the top end of the forks I used the latest handlebars manufactured by Competition Alloy Technology. These bars are made from heat-treated chromoly with a wall thickness of .049″, and hard-chromed. They are super strong; at 24 ounces, they weigh slightly less than titanium bars, and at $17.95, they only cost about 40 percent as much. They come in most of the popular bends, and are available from Fairway Motorcycles.

I used low handlebars on the project bike. They feel very comfortable, and they concentrate more weight on the front end and will help keep the tire in the groove while cornering.

The brake and clutch levers that I used are standard Suzuki items; they are malleable, so you can bend them back again if you fall. I am not a fan of plastic levers; I think that they have too much flex when you pull them, and they aren't entirely unbreakable.

The twistgrip on the project bike is a stock Yamaha DT2 throttle. It is semi-quick; it will fully open a 36mm Mikuni carburetor, and it costs less than half as much as most of the accessory twistgrips.

BACK END: I decided to build up the lightest practical (but not the lightest possible) rear wheel for the Suzuki motocrosser. Husky, Maico, and Greeves all make superlight rear hubs, but none of those hubs mounts the brake on one side and the rear sprocket on the other side; with the brake and the sprocket on opposite sides, the installation is much simpler (no brake-arm shaft running across the frame). And it helps to even out the torque applied to the swingarm; theoretically, the motorcycle should handle better.



One substitution was the Boyd & Stellings 5¼-pound aluminum swingarm. The three sections are heliarced and then heat treated to aircraft specs.

So I ended up using an aluminum version of the Yamaha YZ hubs. The assembly, which includes the hub, the brakes and backing plate, and the aluminum sprocket, is available from Fairway Motorcycles for $90. Without the sprocket, the hub assembly weighs 8¼ pounds. There are two wheel bearings on each side of the hub, for added strength and reliability.

Eight-gauge spokes in the rear wheel should eliminate any loosening or breakage problems. These spokes weigh about 2¼ pounds, with nipples.

The rim is a trenchless aluminum one. At 3¾ pounds, it is 12 ounces lighter than the lightest Akront. Malcolm Smith's K&N Motorcycles in Riverside, California sells the rim for $25. It's new, and it works very well.

The 400 Suzuki engine develops a lot of power, and you need a big rear tire to handle it. The project bike carries a 4.50×18 Goodyear Super Eagle, which weighs 11½ pounds and has a relatively long life.

By avoiding conventional rim locks, I saved about ¾-pound. Instead, I drilled three holes in each side of the rim (spaced 120 degrees apart) so that I could screw

The gas tank from Big Bear Enterprises is a fiberglass replica of the works tanks, with knee indentations. It reduces the weight at the top of the bike by three pounds, and that makes a big difference in handling.

Raines Engineering fork protectors are new items that really work. They simply clip onto your fork legs. Aluminum units are $4.95 a pair.

half-inch-long sheet-metal screws into the bottom of the beads of the tire. If the tire goes flat, the tire cannot come off toward the inside of the rim.

The 48-tooth aluminum rear sprocket weighs slightly less than ¾ pound.

The complete rear wheel weighs 27¾ pounds, as compared with the Suzuki works bike rear wheel, which weighs 29 pounds, and the standard 400 Suzuki wheel, which weighs 36 pounds.

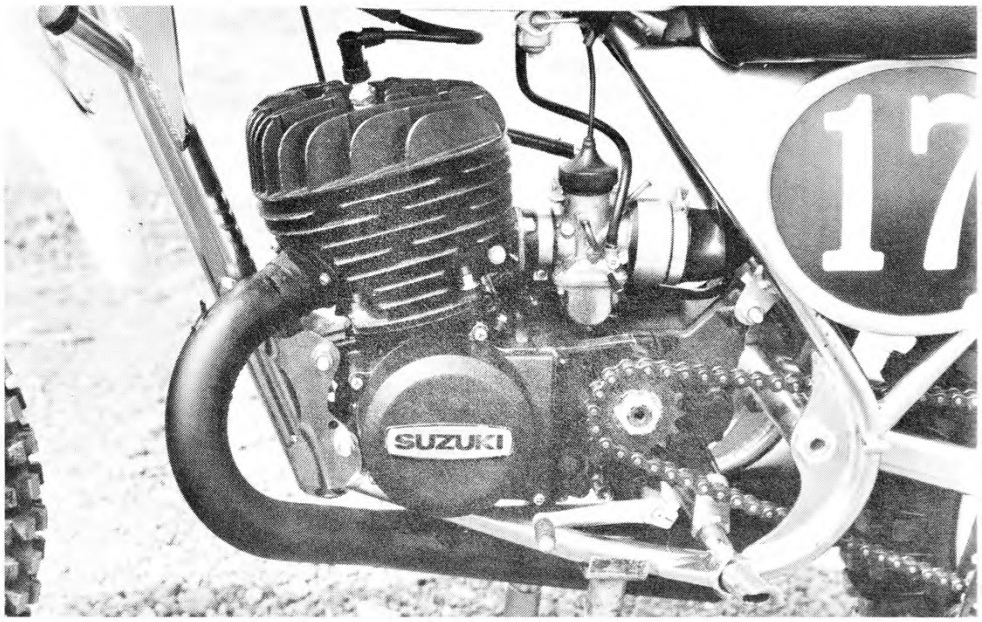
I selected S&W shock absorbers for the project bike. They are new on the market, but they seem to combine the superb damping characteristics of a Girling shock with the longevity of a Koni. The best feature of the S&W shock is that it doesn't seem to change its damping characteristics very much when the fluid inside gets hot. The S&W shocks are sold by Webco, in Venice, California.

In selecting springs for the shocks, the ideal setup is to get the softest springs that will do the job (bottoming out only occasionally). I weigh about 195 pounds, and for the kind of riding I do, the S&W 45/70 progressive-wound springs proved best; heavier (or faster) riders will need the 60/90 springs.

ENGINE MODIFICATIONS: The Suzuki TM engine is well-designed, and it puts out all the horsepower that anybody can use. But the powerband is too narrow, so I took the engine to Downen's Motorcycles, one of the best-known high-performance shops around Southern California. Dave Downen said he thought he could widen the powerband *and* get more horsepower.

He didn't do much to the porting; he opened up the inlet port a little bit, similar to the specifications suggested in the Suzuki workshop manual. He left the rest of the ports at their original dimensions, but he matched and polished them carefully.

The next step was to replace the motocross piston with an enduro piston, which has a less-radical skirt.



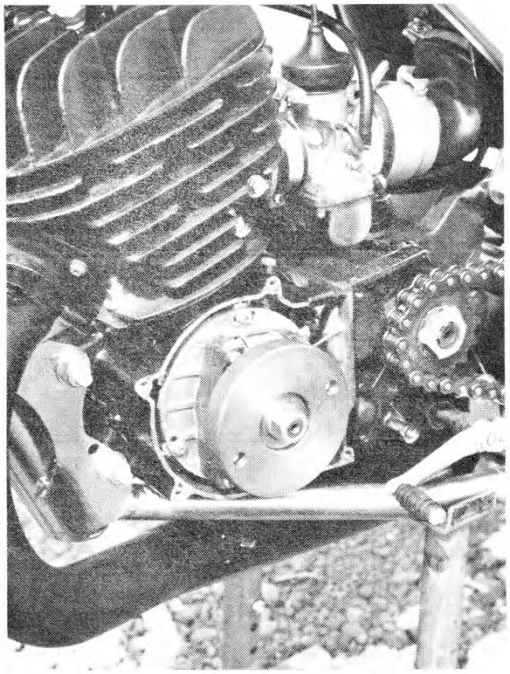
The 36mm Mikuni adds extra ponies and fits quite nicely. The torque pipe requires no modifications whatsoever to fit the Cheney, and it has a good powerband.

Downen installed a 36mm Mikuni carburetor; he has learned by experimentation exactly which carburetor components to use in order to satisfy the breathing requirements of this modified TM engine.

Downen wanted to give the engine more flywheel effect. There are a couple of ways to do that. One way is to take off the motocross PEI (Pointless Electronic Ignition) alternator, and install an enduro PEI alternator, which has a heavier crankshaft rotor. But Downen elected to keep the motocross alternator, and make its rotor heavier by adding a torque wheel from Big Bear Enterprises. They offer these rotor weights in two useful sizes for the TM 400 engine, at 1¾ and 2¼ pounds; the price is $11.95.

The TM 400 has straight-cut primary-drive gears, so Downen beveled them. This adds a little horsepower, but more important, it reduces the engine's operating temperature by cutting the friction. Then you can use less oil in the transmission—and sometimes a lighter weight of

Cheney fork crowns are made of cast aluminum and weigh only 4¼ pounds, including the fork stem. Handlebars are made of heat-treated chromoly and weigh only 1½ pounds. Throttle is "El Cheapo," from a Yamaha DT2.



Torque wheels are one of the most important items to smooth out the powerband of the Suzuki. The units are available in 1¾, and 2¼-pound sizes.

The rear wheel assembly weighs about 28 pounds. Cheney axle adjusters are foolproof. Upper shock mounts allow slight side play and let you remove springs by simply unscrewing top retaining screw.

oil—thereby eliminating some more friction.

Almost everybody who races a 400 Suzuki throws away the oiler. Rather than cover the hole in the left-rear engine case, Downen heliarced the case and then machined it, to get a flat surface. Then he plugged off the oil-feed passages running into the cylinder and the cases, to avoid an air leak which could cause a seizure.

More important than the gained horsepower is the widened powerband, which is precisely what is needed on a motocross course. Next month, *Cycle Guide* will put the project bike on the dyno, and I—for one—will be highly interested to learn what the horsepower and torque curves look like.

In this modified engine I am using Champion gold-palladium sparkplugs, gapped at .021", in the N3G or N2G heat ranges, depending upon conditions. My experience has been that the gold-palladium plug—with its fine-wire center electrode and smaller ceramic insulator on the tip—has a broader heat range, fouls less often, has a longer life, and gives easier starts.

Desert racers may be interested in Don Vesco's "Skinny-Fat" tank. It's unbreakable plastic, and holds 3.5 gallons.

MISCELLANEOUS: The standard Suzuki air cleaner assembly is basically well-designed. Installed in a Cheney frame, the unit is a semi still-air box that is protected from water and dust. But it doesn't pass enough air, so you should enlarge the hole in the plastic cover that shields the filter element. And most people switch to a K&N or Torsten Hallman element for maximum air intake.

The standard Suzuki seat weighs about seven pounds. I used the Cheney seat base, and had C&J Precision Products lay on their trick foam and cover it. The foam is firm yet soft, and the rounded corners make the seat very comfortable. The new seat weighs only 4¼ pounds.

Fuel tanks are available in aluminum, plastic, and fiberglass. Aluminum dents easily, but it doesn't normally leak; plastic is rugged, but it often looks cheap; and fiberglass looks the best, but it will crack and leak if it isn't mounted in rubber.

The tank on the project bike is a fiberglass replica of the Suzuki works tanks, available from Big Bear Enterprises and selling for $49.95. The tank holds 1.3 gallons; it weighs 3¼ pounds, which is 3 pounds lighter than the stock tank. The rear part of the tank has been contoured to fit a rider's legs and knees when he's standing.

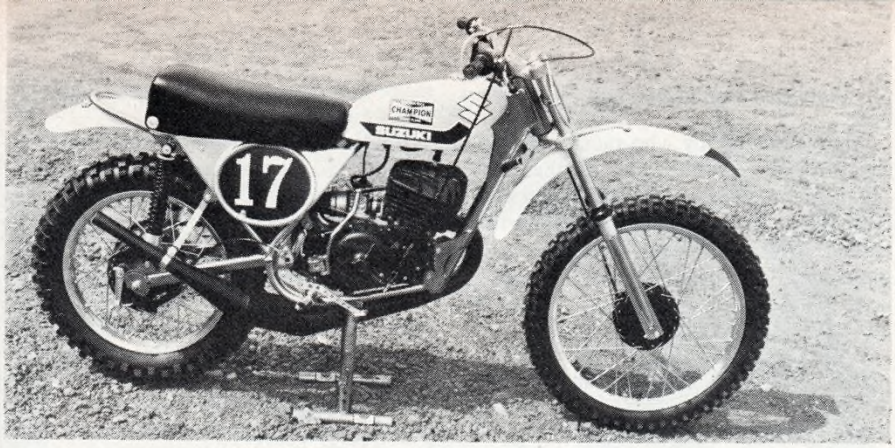
The Big Bear tank comes in yellow, so you can save an expensive paint job by merely buying the Suzuki logo strip from your dealer and slapping it on. A stock Suzuki petcock fits the tank, and a leakproof Circle Industries gas cap comes with the tank.

Fenders are available from several sources. Suzuki fenders from the 125 model look very sexy. Ocelot Engineering, of San Bernardino, Cal., manufactures good-looking plastic fenders, in yellow or white.

The rear axle on the project bike comes from Boyd & Stellings; it is heat-treated chromoly, and it can withstand a terrible amount of punishment.

The '73 stock Suzuki expansion chambers are rugged, although the screen-door silencer isn't very quiet. For more mid-range torque (at the expense of high-rpm horsepower), use a Torque Engineering chamber. Their standard pipe weighs 5¼ pounds with a silencer, and they have a quieter model (Whisperin' Smith: 86 db) that weighs eight pounds.

MODIFICATIONS TO YOUR STANDARD SUZUKI: If you can't afford the full-scale Cheney approach, you may be able to make some important improvements to your stock Suzuki.



The stock '73 frames handle a great deal better than the earlier ones. Many shops can lower those earlier frames, and there are lots of handling-improvement kits on the market. You can get a great deal of improvement simply by substituting 12.9-inch S&W shock absorbers with softer springs.

By substituting a lightweight gas tank, you'll get rid of the topheavy feeling.

To help the engine breathe better, replace the filter element with the K&N or Hallman element.

At the exhaust, remove the screen door from the inside of the expansion chamber.

The stock gearing is very tall. For motocross use, you might prefer to start with a 15-tooth countershaft sprocket, and a 48-tooth rear sprocket.

If your wheel spokes loosen or break too quickly, replace them with Buchanan eight-gauge spokes.

Pay particular attention to keeping the swingarm greased well. If the swingarm freezes to the pivot bolt, the performance of the rear suspension goes way down.

To reduce vibration, replace the engine-mount nuts and bolts with high-tensile American 7/16-inch bolts, and aircraft lock nuts.

SUMMARY: That's about it. As project bikes go, the Suzuki works replica was incredibly easy to build. The Cheney frame is so well designed that you don't have to worry about the parts fitting, and the Suzuki engine is powerful, durable, inexpensive, and most important, available. Suzuki claims that their works bikes cost about $15,000 each. If you are careful, if you plan right, and if you have a little bit of extra time, you can end up with a bike that is actually lighter than the works machines, for a lot less money. Or to put it more exactly, if you heart is set on spending the full 15 thou, you can have yourself your Cheney Replica and a Ferrari Dino (without air conditioning). ***CG***

Watch the January issue of CYCLE GUIDE for a complete track test of the project Cheney/Suzuki . . . (ed).

COMPONENT WEIGHT

Item	TM-400 Suzuki	Cheney/Suzuki	Difference
Frame	26 lbs.	23½ lbs.	2½ lbs.
Kickstand	1¾	0	1¾
Swingarm	8½	5¼	3¼
Torque Arm	1	¼	¾
Rear Axle (with spacers and chain adjusters)	2	1	1
Shock Absorbers (pair)	6	6¼	+ ¼
Expansion Chamber with silencer	7	5¼	1¾
Rear Wheel Assembly	36	27¾	8¼
Brake Pedal & Cable	1	1	0
Chain	2¾	2¾	0
Chain Oiler (with oil)	2	0	2
Engine (dry)	73	73	0
Gas Tank	6¾	3½	3¼
Seat	7	4¼	2¾
Front Wheel	21½	18	3½
Front Forks (with crowns)	21¼	17¼	4
Front Fender	¾	¾	0
Rear Fender	1¾	1¾	0
Handlebars	2½	1½	1
Miscellaneous	17	17	0
Total	245.5 lbs.	210.0 lbs.	35.5 lbs.

LIST OF SUPPLIERS

Knobby Shop International
P. O. Box 1592
La Jolla, Calif. 92037
(714) 278-6212

Boyd & Stellings
2111 So. Grand Ave.
Santa Ana, Calif. 92705
(714) 557-3915

Cole Bros. Motorcycles
5906 Lankershim Blvd.
North Hollywood, Calif. 91601
(213) 980-3715

Big Bear Enterprises
1932 E. Eucalyptus Lane
Brea, Calif. 92621
(714) 529-3876

Fairway Motorcycles
1350 Yorba Linda Blvd.
Placentia, Calif. 92670
(714) 524-1205

Torsten Hallman Racing, Inc.
5345 Timken St.
La Mesa, Calif. 92041
(714) 460-6234

Malcolm Smith Racing Products
1689 La Cadena Dr.
Riverside, Calif. 92507
(714) 686-8014

Webco, Inc.
Box 429
Venice, Calif. 90291
(213) 399-7724

Downen's Cycle Center
11835 E. Carson St.
Hawaiian Gardens, Calif. 90716
(213) 865-8223

C & J Precision Products
3873 So. Main St.
Santa Ana, Calif. 92707
(714) 540-7350

Circle Industries, Inc.
2536 Seamen
South El Monte, Calif. 91733
(213) 444-4526

Torque Engineering Co., Inc.
19755 Bahama St.
Northridge, Calif. 91324
(213) 882-4321

Ocelot Engineering Products
940 Kendall Dr.
San Bernardino, Calif. 92407
(714) 882-1761

Don Vesco Yamaha
765 El Cajon Blvd.
El Cajon, Calif. 92020