

Bridgestone's 350 GTR is a motorcycle that really caught my fancy. As we explained in our August, 1967 report, it has been designed right out to the limit of two-stroke technology, having features seldom found in any but pure racing motorcycles. A 6-speed transmission, for example, driven through an outboard-mounted dry-plate clutch. And all-aluminum cylinders with chrome-plated bores. The intake system is of the racing rotary-disc variety, and racing practice is again observed in feeding oil directly into the engine's crankshaft. In every way, it was a natural for road racing, and it brought out the experimenter in me like few things have done.

Coincidentally, it became painfully obvious that I would be needing a "ride" for the 1968 racing season. The Harley-Davidson KR-based "Secret Weapon" that I rode at Daytona in 1967 was finished. It had broken a piston-pin at Daytona, and the ensuing lashing-about of con-rod and bits of piston fairly completely did it to the entire engine. A new engine would have cost about \$1500 and that was more money than I, or my partner in the project, Jerry Branch, wanted to pour into the machine.

Anyway, we had proved our point (that it is possible to build a KR down to the size of a Sprint) and I was looking for other mischief to occupy my time. The Bridgestone 350 GTR engine looked like a good starting point, as the entire engine/gearbox unit weighed only 116 pounds, wet.

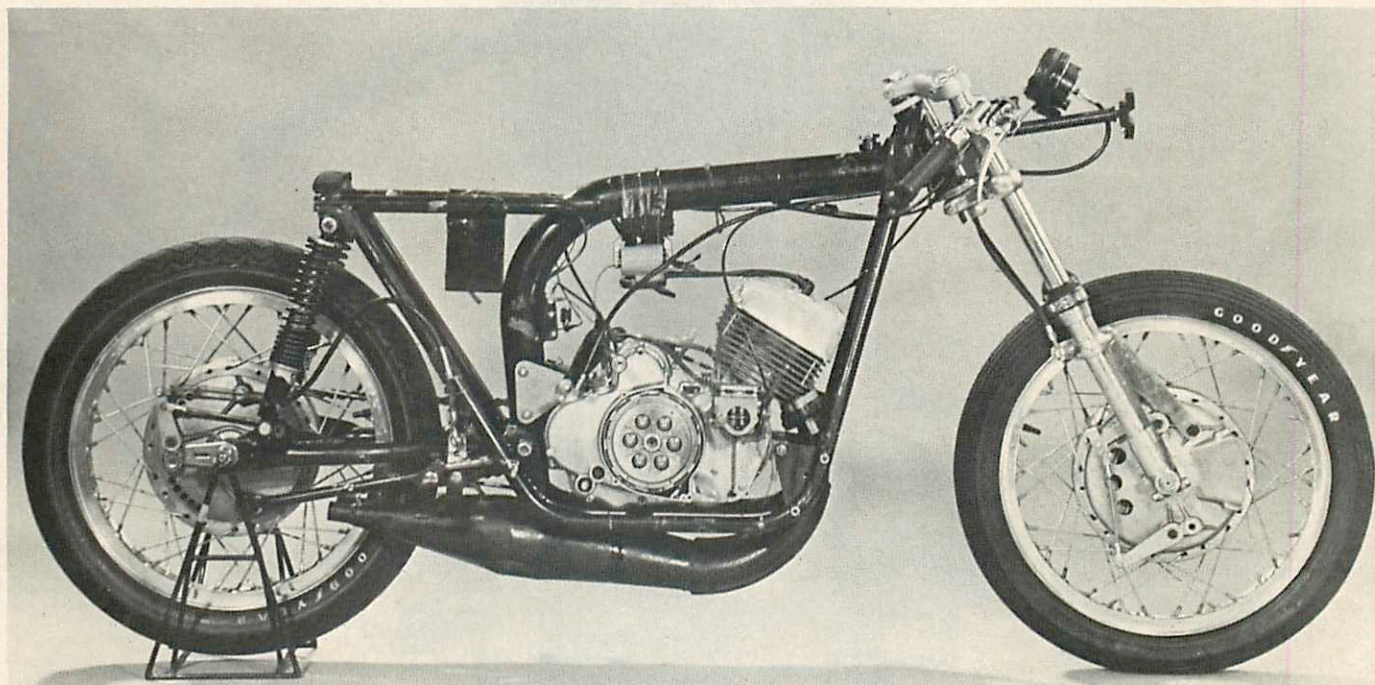
Thus began the project to build what the staff irreverently referred to as "Son of Secret Weapon." But in this case, the son was to be completely unlike the father. Obviously, you couldn't expect physical similarities, when the KR engine is a living-fossil sidevalve V-twin and the Bridgestone a super-modern two-stroke, but the differences between these projects was to be greater than mere appearance. The KR was strictly a one-off, built around a special short-rod engine that had spent more time in a machine-shop than is decent. I suppose a really determined enthusiast could have duplicated the bike; the job would have kept him busy for at least 6 months.

With the Bridgestone project, I had something quite different in mind. It was to be everyman's home hobby-shop racing bike. A collection of available hardware—and the best hardware available. The

BY GORDON JENNINGS

SON OF SECRET WEAPON

Wrapped around a Bridgestone 350 GTR engine is a collection of highly-specialized but entirely available racing components: Ceriani forks, Koni shocks, Fontana brakes all-around, and a prototype Van Tech frame.



people at Rockford Motors, the Bridgestone distributors, were most helpful in this regard. The AMA won't let you use just anything that falls to hand, or wallet, in their road races. Everything must be "approved" and approval has to come from the manufacturer of the motorcycle, or the American distributor. Rockford Motors' John Emery (who is a racing nut anyway) said they would take care of approval papers on any good hardware I might select.

Part of the selecting process was easy. Ceriani road racing forks are the best around, and they are available from Steen's Inc., or ADI. And the best road racing brakes I knew about were those made by Fontana, in Italy. They are also available—by order direct from Italy or from a couple of specialist suppliers here in the States.

Miscellaneous hardware was available from a number of sources. I chose to use Honda clip-on handlebars; footpegs, brake and gear-shift pedals, and shift linkage from Yamaha's TD-1 road racer; and a rear brake cable from a Kawasaki A1-R. Most of this stuff can be fabricated from bits of plate and tubing, but I know all too well what it is like to throw a bike down the road and bend things. The Honda bars aren't all that easy to replace at the track (your friendly, local Honda dealer won't have them) but the

Honda scrambler levers are available anywhere, and that's what I clamped on the bars.

Yamaha and Kawasaki will not be enchanted with the notion of selling you their racing hardware to bolt on a Bridgestone motorcycle, but if you're sneaky (and when it comes to racing, I'm sneaky) you can get these items by ordering them on the sly from some dealer. And you should get two of each, as a fall can smear them right off of the motorcycle.

I should also mention that if you use a 4-shoe front brake, like the Fontana unit, you will need some type of mechanism to link the handlebar lever to both brake arms (each of the two backing plates has two arms, but these are connected by an adjustable rod, and you only have to pull one of them.) If the brake is to work properly, you have to include a balance-bar in the system to divide the cable-pull between the two sides of the brake. This can be a pivoted bar attached to the brake lever, to which the cables are linked; or a similar bar on the handlebar right next to the lever, to hold the cable housings. You can make a setup like I just described—or you can take the easy way around the problem and buy a cable assembly from Harley-Davidson with the balance-bar contained in a little rectangular junction-box. H-D's 1968 and later CRTT Sprints have a 4-shoe Ceriani front

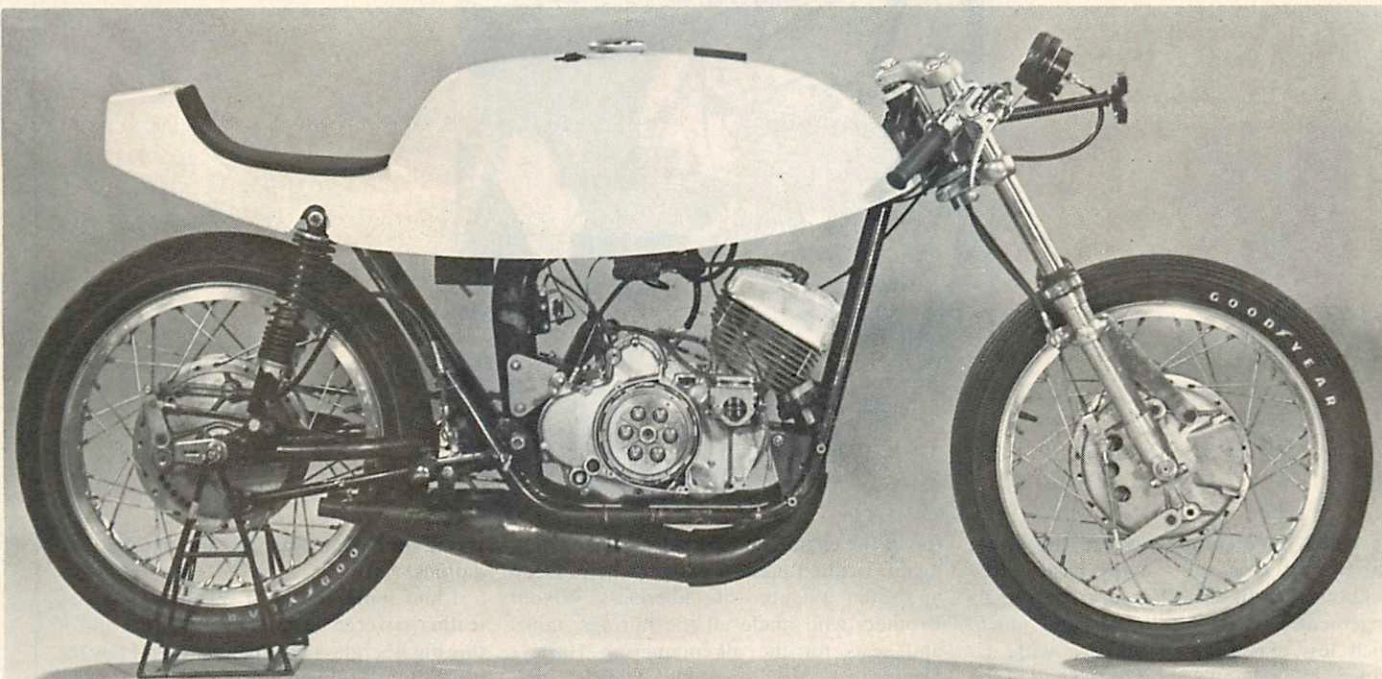
brake, and the cable/junction-box/balance-bar assembly is made for that Sprint. It works well, and is a bolt-on proposition, which is a very good thing as there is never enough time to do all the tricky things you have to do to make a racing motorcycle.

So that gave me wheels, brakes, handlebars and a lot of miscellaneous hardware. Between them was the Bridgestone engine. A frame was needed to connect everything together. I considered (briefly) using the stock frame, which is just about light enough and strong enough for road racing, but is tall like any touring frame. Too tall, in fact. The Bridgestone promised to be very strong for a 350, but it *is* a 350 and is giving away a lot of piston displacement to Triumph 500s and such, not to mention the 750cc H-D KRs.

But there were no frames available for the Bridgestone 350 unless I wanted to use one of the Rickman frames—and those were all made for larger and heavier engines and rather expensive as well. I had already spent too much money on forks and brakes, and assumed that probably the reader's bankroll would be depleted at the same point. Racing is inherently expensive, but I thought it was best not to let it get completely out of hand.

Here is where one of my friends and fellow experimenters came into the picture. Bill Van Tichelt (better known as Bill Van-

The racing two-stroke's great thirst and the need for a full 100-mile range on a single fueling were responsible for this "legal-maximum" 6-gallon tank and seat combination in fiberglass, made by the famous Wixom Bros.



Tech) had been threatening to build a "big" frame to compliment his special frames for Yamaha 100, Honda 90, etc. engines and so I roped him into a scheme to do it right away. That imposed certain limitations on the design, as the frame we chose would have to be suitable for a variety of engines in the 250-500cc displacement range, but it would at least yield a low-cost (relatively) frame and one that would be available to anyone who sent Bill an order and money.

In one long-ish meeting, in Los Angeles, Bill and I managed to settle on basic design requirements, but did not really arrive at any firm decisions. And then I had to return to New York and the business of producing magazines. We agreed to work on the problem, Bill in L.A. and I in N.Y., and compare notes when I next came to California.

The next couple of months I spent my evening hours on the drawing board, trying different layouts and calculating stresses. Bill was doing much the same thing in Los Angeles. And when I made that trip to the west, and went to see Bill, I discovered that we had arrived at almost exactly the same frame—even to the tubing diameters and wall-thicknesses.

This was not quite as remarkable as it might seem. Both of us are firm believers in "backbone" frames, in which a single large-diameter tube links steering-head with swing-arm pivot, and it was natural that we

should both incorporate the backbone-tube concept in our finished design. And of course the backbone tube alone was not enough; there are a number of engines that simply will not mount under a big tube. Most engines have mounting lugs made to attach to a pair of "cradle" tubes running in front, under and behind the engine/gearbox unit. So we simply added cradle tubes under the backbone tube and gained the best of both worlds—with a slight weight penalty.

To leave room for the maximum variety of engines, the backbone tube was given a nearly-90-degree bend, above the swing-arm pivot. This would clear a carburetor extending right back from the middle of most engines, and it did not effect the rigidity of the frame to any great extent. The loads on a backbone tube are largely torsional, and the degree of torsional rigidity is a function of tube diameter, wall-thickness and tube length. Bends have little or no effect.

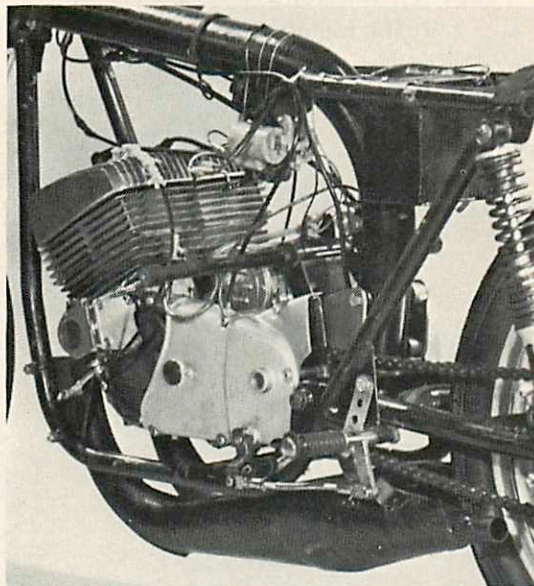
The reason for my enthusiasm for backbone-tube frames is that the greatest load, on a road racing frame, is applied at the steering head. The forks act as a long lever, and there are some real jolts being fed against the side of the tire when the bike is heeled over in a turn. A big tube provides maximum resistance to flexing under twisting loads applied at the steering head. Similarly, the stresses coming up from the

rear wheel, through the swing-arm, to the swing-arm pivot are best resisted by a single large tube. You can use a number of smaller tubes, but as the torsional strength of tubes increases as to the fourth power of diameter, the frame's strength/weight ratio will be best with a single big, thin-walled tube.

Bill and I had both settled on a tubing wall-thickness of .065", as this was thin enough to give lightness with the tubing diameters selected (2½" for the backbone; 1" for the cradle tubes and rear-shock-mounting framework) while also being thick enough to bend and weld without undue difficulty. The swing-arm, which is very heavily loaded on any motorcycle, was made of 1½" diameter tubing, with an .095 wall-thickness. We decided to use mild steel throughout. It would sound good to say that we used 4130 chrome-molybdenum steel, but the truth is that the modulus of elasticity is the same for all steels, and modulus of elasticity is what determines rigidity for any given structural configuration. So all you get with fancy steel alloys is a crash-proof frame. And, as a really bad crash occurs very seldom, it appeared a better deal to have the low-cost, easily-fabricated mild steel tubing.

As a design, the big Van Tech/Cycle frame is completely straightforward except for the swing-arm mounting arrangement.

**Maximum use was
made of stock hardware,
as in the footpegs and gearshift linkage
from a Yamaha TD-1, and the rear
brake from Kawasaki's A1-R.**



We could have simply pivoted the swing arm from a cross-tube at the base of the backbone, just like another fork-bearing arrangement, but it was lighter and much, much less expensive to make a wide U-shaped channel and weld it to the end of the backbone tube. The open side of this channel faces back, and the forward pivot-tube end of the swing arm fits inside. At its ends, the channel is welded to the cradle tubes, so all of the loads are fairly well resolved. It looks right on the drawing board, and in metal, and there has never been any evidence of frame flexing in subsequent test-riding.

Actually, our most difficult choice was steering-head angle. Bill is a dirty old dirt rider, and he wanted to crank about 30 degrees (from the vertical) of rake into the forks. I was planning to go to Daytona, and heldout for a 27-degree head-angle. I convinced Bill, and myself, that this would give good handling on both dirt and road-racing versions of the new frame. It was a mistake, as it happens, but more of that later.

Another big problem was a suitable fuel tank. Two-stroke engines are very thirsty, and a bike has to go 100-miles on a tank of gasoline at Daytona. That meant a tank capacity of some 6-gallons, which is the maximum allowed by the AMA. But how do you get a six-gallon tank on a bike without having it look like a fiberglass watermelon? Especially when you have to provide a big groove right up the tank's underside to accommodate that big backbone tube?

The answer seemed to me to be that you use to maximum advantage the space between the rider's seat and the handlebars, and do likewise with the space between the

top of the engine and the rider's torso. Here again, I called upon friends for help. Dean and Stan Wixom (the fiberglass Wixom Brothers who made all the fairings, tanks and seats for the all-conquering Harley-Davidsons) are long-time friends, and suckers for an interesting project. So I asked them for help, and they said yes, they would make a tank for me. The only snag was that I had to provide the male plug from which they would take a female mold and in which they would lay-up a tank.

That was all right with me, because it gave me a chance to make exactly what I wanted (or *thought* I wanted.) What I wanted was a combined tank and seat, all in one piece, and I had made some drawings from which I took dimensions and sent them to the Wixom Brothers. They then sent me a chunk of plastic foam just slightly bigger than the seat/tank I wanted, and I carved the foam to the desired shape. And while I was about the job, I gave myself plenty of room for my 6-foot frame. I have been cramped on practically every road racing motorcycle I have ever ridden, and this time by Gadfray I was going to be comfortable.

The Wixoms made a mold from the foam plug, then grooved the bottom of the plug until it would fit down over the frame neatly, and finally stuffed what was left of the plug into a big barrel of water. This was done to get some idea of the volume available between tank-top and frame. As it happened (not entirely by accident) the volume was some 7.5-gallons, so they shaved away at the base of the plug until it displaced 6-gallons, and then used it as a form to make a mold for the tank bottom. That's the procedure you follow if you are

trying to make a 6-gallon tank that holds 6-gallons.

I had some notion of snapping a snappy leather-covered cushion over the seat-end of this big fiberglass banana, but then I saw the neat foam-rubber pads that Harley-Davidson was to use on *their* racing seats. The stuff is only an inch in thickness, but is amazingly comfortable—and of course it is cheap and easily replaced.

This tank/seat combo was made, sent to me, and I dropped it onto the frame. It was kind of bulky, but I liked it and even JayTee (Jess Thomas) thought it was somewhat better than a poke in the eye with a sharp stick. We tried it on his Kawasaki A1-R and it fit that even better than the Bridgestone—which vexed me just a tad—and it was also a fair fit on my own TD-1 Yamaha. But it went on the Bridgestone. I used a single bolt to tie the seat onto a padded cross-strap at the back of the frame, and short bungee-cord to snug the front of the tank against pads taped around the frame.

I also had to make-up fairing mounts, which consisted of a cross-tube bolted to the rear engine mount and a stem extending straight out ahead of the steering head. This last also provided a spot for attaching the tachometer-mounting bracket. The standard Bridgestone tach was retained, as it reads up to 12,000 rpm (more than I planned to use) and is very big and readable. Also, it fits into a very tricky rubber-bushed mounting ring which I also used.

And that takes care of the chassis, except for the choice of rear shocks, a subject that will be covered as this story unfolds in future issues, along with a complete run-down on what was done with the engine. *That*, we'll tell you about next month. ©