

Cycle

THE BEST
650 TOURING BIKE
EVER TESTED:

BENELLI TORNADO

THREE FOR
THE
ROUGH:

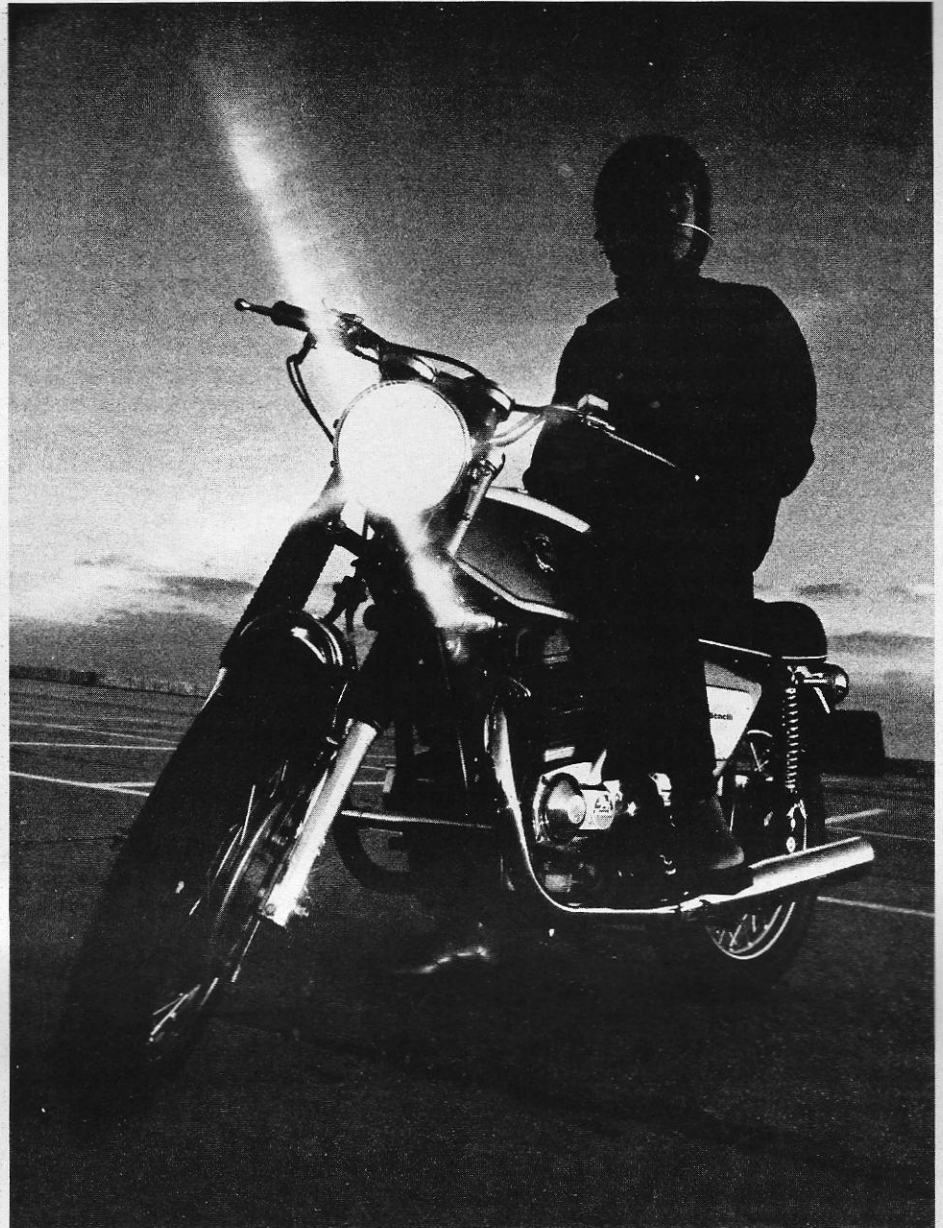
OSSA
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PIONEER

RICKMAN
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METISSE

YAMAHA
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ENDURO



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GLENN SKENA
BX 286
NORTH HILLS RD 3
MURRAYSVILLE PA 15668



CYCLE ROAD TEST

Benelli 650 Tornado

It's the only bike we enjoy riding really hard as much as we did the Honda Four.

The 650 Benelli twin has been a long time coming. Our first glimpse occurred about a year and a half ago at the Benelli factory in Pesaro, Italy. That bike had a marvelous ultra-short-stroke engine shoehorned into the same pseudo-Rickman frame that Benelli had sold to Montgomery-Ward. We weren't quite sure who was trying to fool whom with that first quickie lash-up, for the resulting bike vibrated alarmingly, had a super-restricted exhaust system that separated the engine from its potential, and handled atrociously.

The sole surviving remnant of that first pelican is the tremendous engine; everything else has been replaced by components which match the engine for quality. You begin to notice the quality as soon as you concentrate on the first items of concern in the starting procedure: the fuel valves. The body of each valve is a precision-machined aluminum-alloy cube, fastened to the tank with a swivel

nut and sealed with a nylon compression washer. A valve cylinder is secured in the body with a chrome-plated sleeve nut and sealed with neoprene O-rings. When you pivot the valve lever to one of the three positions, there is a smooth, cushioned feel that is followed by a distinct *click* at each position. Wow—no more groping in the dark or getting off the bike to eyeball-align the positions. A small *c* on the front of each valve indicates the closed position, straight down is *on*, and a small *r* at the rear shows where reserve is. A transparent sediment bowl holds the carb supply banjo to the valve body. They're the nicest valves we've ever seen on any bike.

A very awkward spot was chosen for the ignition key. It's down on the right side panel, under the seat, situated to gouge the passenger's calf and get accidentally switched off. One click clockwise on the key gives ignition only; the second makes for lights and igni-



tion. Turning the key counter-clockwise from *off* turns on the taillight for safe night parking.

If the engine is cold, a smaller lever on the front brake lever bracket opens a richening device in each of the twin 29mm VBH Dell'Orto carbs. Leave the throttle closed: the richening system has its own air supply that is accurately metered. The kickstarter is a one-piece forging that pivots out for starting on a heavy boss down near the shaft, much like the Honda arrangement. The wide face of the boss forms a pleasing shield that doesn't bite your shoe or irritate your leg. A healthy lunge with the full momentum of the rider's weight is required to swing the starter full-course, but the engine always starts on the first effort.

The average temperature during our test was about 40°F. For a cold engine start, the best procedure is to leave the richening lever full open for about two minutes. The tach reading stays at 2500 until engine heat rises slightly and the exhaust note begins to stagger. Close the richener about halfway and pull the clutch while lifting the right side foot pedal to engage low gear. Pedal travel in this operation is a full two inches, which means lifting your foot completely off the peg. Pedal feel is deliberate rather than crisp, but there is no disconcerting mechanical noise or lurch to make shifting an unpleasant experience.

A fairly stout clutch pull of 18 pounds is made less of a bother by the smoothness of the release. Simultaneous partial opening of the throttle and releasing of the clutch lever produce absolutely ripple-free starts. Another feature that allows effortless clutch operation is the shape of the hand lever. It's really designed to fit the human hand: a maximum width of $\frac{9}{16}$ ths of an inch spreads the load across the full width of the second joints of the two middle fingers, and tapers from there to fit the first and fourth. And the cor-





Handling is clumsy and top-heavy at low speeds, but out in the twilight zone on twisty mountain roads the big 650 comes into its own.



The best 650 touring bike we've ever tested.

ners are rounded perfectly to prevent pinching.

A knurled knob built into the lever bracket adjusts the cable slack. The knob has a detent plunger that clicks twice per revolution to allow safe adjustment on the road. Most bikes have a lock nut on the adjuster which means you sometimes have to use a pair of pliers.

Taking our foot off the peg to push the pedal down four inches into second gear, we noticed several obvious characteristics of the Tornado's nature. First was the incredible amount of torque produced by the engine at low revs. It pulls like a steam engine from 2500 rpm; and at low speeds the bike handles extremely awkwardly. There is a strong feeling of understeering and top-heaviness. Our third immediate realization was the stiffness of the suspension. From these first impressions, we made a tentative evaluation that if the big Tornado were a success, it would have to be as a high-speed roadburner. We later discovered the accuracy of this judgement.

The ultra-short-stroke engine is a classic rebuttal to the old *long stroke gives higher torque* myth. At 84mm, the cylinder bores are slightly more than an inch greater than

the 58mm stroke. One of Ford's engineers said it all at a cocktail party we attended at Daytona a couple of years ago. "It's all a matter of valve timing and gas velocity in the ports," he allowed. "By squeezing the ports down a bit and reducing the valve overlap, we can make a short-stroker develop as much maximum torque and do it over a wider range of revs. But if you try to extract too much power from the long-stroker, the piston speeds will kill it every time." Of course our friend was speaking on an *all other things being equal* basis, and the extremes he mentioned were well beyond the practical reliability and comfort limits that govern street machines. But Signor Prampolini, who was the chief designer of the 650 engine, must have been thinking in terms of future developments when he chose the Tornado's engine dimensions.

Indeed, there are a few problems imposed by the layout in the present state of tune. To prevent piston slap under high loads, the cylinders are offset 2.5mm to the rear of the crankshaft. Fairly wide squish bands between the pistons and heads are used to negate combustion problems at low revs. Unfortunately the squish bands also prevent the use of the huge valves that can be fitted in a

wide-bore, short-stroke engine.

The layout is basically the same as that of the Yamaha 650 and the Honda twins in that the crankcases divide horizontally and the engine/gearbox shafts have their centers on the crankcase seam. Horizontally-seamed cases are less prone to oil leaks because there is not a constant pool of oil on a seam that is being continually stressed by the crankshaft pulses. Too, on engines that have support bearings between the crankpins, it is much easier to build strong bearing supports by casting them into the same unit as the cases. On a vertically split twin, this is impossible.

Benelli's twin differs from the Japanese types in that the camshaft is in the crankcase and the valves are controlled *via* tappets and pushrod-operated rockerarms. Actually, the valve train components are almost identical to those developed in Benelli's small horizontal-cylindereed racers (known as Motobi, for MotoBenelli, in Italy), which rev to 11,500 rpm. Since the power peaks of all the 650 twins on the market are right around 7000 rpm, there is no reason why the overhead cam engines are any better. Actually, the pushrods and tappets in the Benelli are so light that the engine breathing could be adjusted to deal with much higher revs, the only modification necessary being stronger valve springs.

A real advantage to using pushrods in this engine is that, when combined with the short stroke, the overall engine is extremely short; but had Benelli chosen to make it a dry sump model, instead of carrying the common engine and gearbox oil in the crankcase, the overall height could have been an incredible 13 inches. A large part of the low-speed handling clumsiness is caused by the high position of the engine. With a dry sump system, the engine, gas tank, and steering head could be four inches lower. As it is, the engine shaft centers are almost four inches above the wheel axles. All that would suffer in the lower center of gravity would be maximum acceleration and braking figures due to the decrease in theoretical weight transfer.

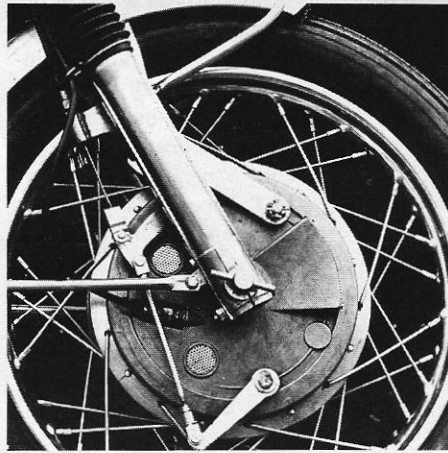
Consummately Italian in nature,
Benelli's big 650 appears conservative yet
baroque to the casual
observer. But a spirited trip
in the admittedly too-
firm saddle brings out that
resolutely silent spirit
that one can only find by trial
in the hard reality of time and space.

Engineering features in the crankcases make the engine strong and quiet. A separate flywheel between the crankshaft pairs allows the use of four huge main bearings: the two outer ones are double row balls and the inner pair beefy rollers. Both the crankpin and wristpin swing on needle roller assemblies. Double row ball bearings support the ends of the camshaft and a pair of pressure-fed plain bearings take the load on the center lobes. To reduce noise, helical gears drive the camshaft in front and wet-plate clutch behind the crankshaft. Both ends of the five-speed gearbox mainshaft are carried by double row balls, while the layshaft ends spin in needle rollers.

The heart of the lube system is a single stage gear-type pump that rests in the center of the engine below the camshaft. The pump draws oil from the crankcase through a fine wire mesh strainer. A cartridge oil filter takes the microscopic metal bits from the bypass line. The crankshaft, camshaft, tappets, pushrods, and rockerarms all receive oil under pressure. Slots in the rods allow oil to sling up on the cylinder faces and small-end bearings. All this oil is kept inside the cases with O-ring seals under the rocker boxes and cylinder heads and paper gaskets with cement on the clutch case.

A quite elaborate crankcase breathing system, composed of baffled towers and an expansion box, work to keep the fluctuating engine pressures from pushing the oil out the seams. When we got our bike, one of the connecting hoses in the breather was kinked and a small amount of oil was weeping from the crankcase joint seam. Straightening the hose dried up the weep. A small amount of oil vapor is carried through the expansion box during extremely hard running. The exit hoses to the box end at the frame tubes, right under the seat. After a particularly spirited ride, a passenger on the Tornado might mistake the warm liquid on his pants leg for lack of control of another kind (until it didn't dry, that is).

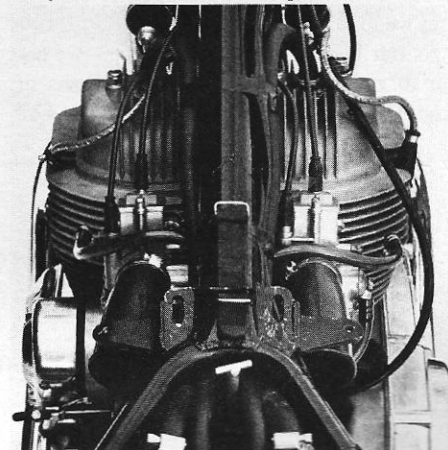
The electrical components, except for the lights and switches, are all German Bosch.



Dual front brake matches 650's speed.



Big grip and strong springs are tiring.



Big backbone frame is rigid.



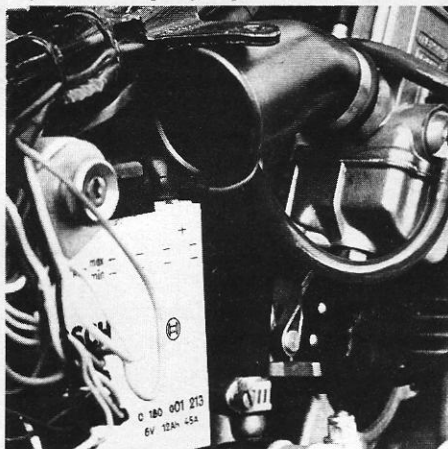
At last the Italians make a good light.



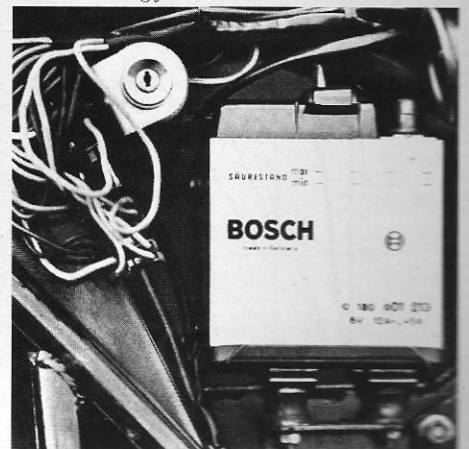
Adjustable rear springs require no tool.



Massive cooling fins surround exhaust.



Lack of aircleaners is unthinkable.



Reliable electrics are shock mounted.

The D.C. generator, points hardware, centrifugal advance, horn, voltage regulator, batteries, condensers, and coils of that marque are all apparently better than could be had in Italy. Not a single electrical failure marred our enjoyment of the big Benelli.

Taken individually, all but a niggling few of the Tornado's components are of unimpeachable quality and thereby functionally honest. As a whole, they almost make it as a styling entity. In a few short words, the bike could be described stylistically as conservative Italian provincial: sort of an expensive connoisseur's machine that refused to swap function for frill. The big 3.75-gallon tank has a rakishly bulbous look, with its tipped-up leading edges—which reveal the ignition coils protruding like Buck Roger's very own personal ray guns. And the white flash of paint on the deep crimson red tank looks like a Kwikkie Kalifornia Kustom job.

While Benelli has reason to feel proud of the results of their labors, they cannot be excused for informing us so rudely, and in triplicate, on each side that *they* really did make the machine. There's a three-inch diameter tank badge with crossed wheat stalks and a gold star surrounding a blood-red panel that spells out BENELLI. Then down on the engine case there is a slightly smaller disc with a gold lion standing with one paw out and tail erect upon a black panel with white letters that spell out BENELLI. More blood-red beneath the black. On the side panel, still another pronouncement: TORNA-DO BENELLI 650 in black and red. Fortunately the latter is a stick-on. But the rest is all real and functional and uniquely Italian. And we love it.

As our bike accumulated mileage, we began to run it harder for longer lengths of time. Our first impression was right. The

faster you ride the Tornado, the happier it is. It likes nothing better than holding a steady 80 mph on the pike, unless of course there's the option of thrashing through the gears on a mountain road. No wind pushes you around on the Benelli and no bump makes you wobble. You're in control all the time. For really hard riding, it's the only machine around that we enjoy as much as the Honda Four.

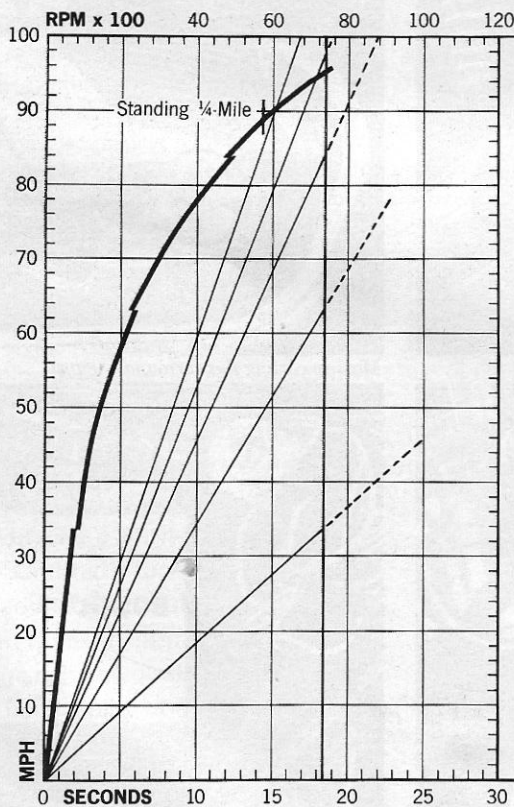
The front forks are built by Marzocchi and they're first rate. Longer rubber gaiters sit atop the polished aluminum legs. A plain heavy-gauge stainless fender with a semicircular section is held between the forks with plated tubular braces in the front and rear. A massive four leading shoe front brake creates more than enough stopping force to make fast riding on the Tornado as safe as it is exciting. Although substituting a zinc alloy for magnesium makes the brake signifi-

Continued on page 70



BENELLI TORNA DO 650 STREET

Price, suggested retail	..... East Coast, POE \$1650
Tire, front	..... 3.50 in. x 18 in. MT76 Pirelli Rib
rear	..... 4.00 in. x 18 in. MT53 Pirelli Universal
Brake, front	..... 9 in. x 1.15 in. x (2)
rear	..... 7.82 in. x 1.15 in.
Brake swept area	..... 93.2 sq. in.
Specific brake loading	..... 6.76 lb/sq. in., at test weight
Engine type	..... OHV Pushrod parallel twin
Bore and stroke	..... 3.304 in. x 2.28 in., 84mm x 58mm
Piston displacement	..... 39.3 cu. in., 643cc
Compression ratio	..... 9:1
Carburetion	..... (2) 29mm Dell'Orto
Air filtration	..... None
Ignition	..... Battery-coil
Bhp @ rpm	..... .57 @ 7400 rpm
Mph/100 rpm, top gear	..... .16
Fuel capacity	..... 3.75 gal.
Fuel mileage	..... 38.6 miles/gal. average
Oil capacity	..... 5.3 pints
Lighting	..... 12v, 150 watts
Battery	..... 12v, 12ah
Gear ratios, overall	..... (1) 17.0 (2) 9.41
	..... (3) 6.8 (4) 5.85 (5) 5.1
Wheelbase	..... 56 in.
Seat height (width) (length)	..... 32 (8.5) (26) in., with rider
Ground clearance	..... 7 in., with rider
Curb weight	..... 470 lbs., with 1/2-tank of gas
Test weight	..... 630 lbs., with rider
Instruments	..... 10,000 rpm tach 160 mph speedo
0-60 mph5.9 seconds
Standing start 1/4 mile14.34 seconds 88.49 mph
Top speed112 mph



2
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DAYTONA BEACH, FLORIDA

BENELLI *Continued from page 32*

cantly heavier than a racing counterpart would be, it also makes the brake economically feasible. Better to have that powerful brake a little bit heavy than not have it.

Resting on top of the forks is the most powerful headlight we've ever seen on a motorcycle. Listed as 40/45 watts low/high beam rating, the unit is made by the Italian CEV firm. For a long time we thought that there was some sort of genetic fault that prevented Italians from making good lights. Probably, closer to the truth, no one ever wanted to pay the price. On low beam, the focus is amazingly precise; it cuts the darkness with a broad flood of light which reaches out about 30 feet. While there is no road-level glare to bother oncoming traffic on low beam, there is a group of small rays that shine up at about 60 degrees to illuminate overhead signs. On high beam the light generates a kind of death ray. You can see the finish line from the start on an unlighted dragstrip. The only time you need the high beam is when you are alone on a deserted road, and really need to see that cow or deer.

The headlight assembly and instruments are mounted to the fork brackets with rubber doughnuts that have studs vulcanized to each end. The arrangement is quite flexible and the components move a lot when the bike encounters bumps. We found no problem with instrument visibility or road illumination due to the bobbling. The mounts did contribute to one of the minor flaws in the bike. Several items tend to lose their protective finish and rust quickly. The stud ends on the rubber mounts are real eyesores in this respect. While on the subject, we might as well bitch about the painted spokes. A splash of gunk, and off comes the paint; a splash of water to remove the gunk, and on comes the rust. A real bummer for a bike of this character, or any bike for that matter.

Instrument lighting is poor. All you can read is the *Made In Italy* sticker in either the tach or speedo.

The absence of any semblance of an air cleaner baffled us considerably. A first we thought that someone had accidentally forgotten them. But a call to the importer, Cosmopolitan Motors, in Hatsboro, Pennsylvania, confirmed that none had come with the first shipment of machines. They were still waiting for a reply from Benelli. We fastened a tubular Filtron element #1911 to each carb bell and they worked fine. Noise level during cruising and acceleration dropped considerably and engine life expectancy rose by an easy 60 percent.

Riding the Tornado around town in stop and go traffic brings out one of the two major component weaknesses. The throttle is very hard to turn. We thought at first that simply installing softer carb slide springs would remove the unwanted forearm builder. As things turned out, the heavy springs covered up a problem with the carbs. The slides in the Dell'Orto carbs

are square. Apparently it is difficult to cast the square hole accurately enough to fit the slide properly, for both carbs on our test bike had sloppy slides. If the slides were left to rattle loose, the Tornado would have acted just like any bike with worn-out slides: the engine would have run very erratically at idle. To overcome the loose tolerances, Dell'Orto chose to use heavy springs which jam the slide laterally against the engine side of the carb body. As a result, throttle action is jerky and the engine is prone to dying while you wait for a light or fish a quarter from your pocket at a toll booth. The primary-mounted kick-starter, which allows starting without returning to neutral, is a real temper-saver in such instances.

Out on the highway, the stiff throttle joins forces with fat (1½-inch diameter) grips to induce arm cramps within the first 50 miles. A friction brake on the throttle would lessen the whole problem, but the final solution would be to give the Tornado just what it deserves: a fine constant-velocity carb pair like the one on the Yamaha 650 or Honda 450.

Our sole remaining gripe is with the hard seat. We firmly approve of the stiff suspension that contributes towards the Tornado's superior road holding, but we think that the rider need not suffer the consequences of good handling in his spine and kidneys. The seat's shape is fine. Replacing the hard, single density, single resiliency sponge with some more carefully selected material would give the Benelli 650 owner the best of all possibilities: good handling along with reasonable comfort.

Maintenance is about on a par with current motorcycle standards in that it takes far more time than it should. A few grease fittings on cables, pivot bearings, and wheel bearings would save the owner a lot of time and money.

All the adjustables are straightforward and easy. The ignition timing and generator pulley tension can be set by removing the left engine cover with a five mm hex key from the kit. After the points gap is set, the timing can be quickly adjusted with an automotive timing light flashed against the marks on the generator pulley and crankcase. Belt tension is changed by removing or adding spacer washers between the pulley halves, exactly like on a VW.

The fuel tank can be removed in two minutes with a 10mm wrench from the kit. With the tank off, the owner can take off the rocker box covers and adjust the clearance. The carefully detailed manual covers all the maintenance procedures.

Extended saddle time only served to reinforce our original liking for the Tornado. The more miles it accrued, the smoother and more responsive it got. It didn't start vibrating or leaking oil or making strange noises. With the fixes made to the relatively insignificant problems we found, Benelli's Tornado would be a perfect 650 touring bike. It's already the best we've tested. ©