

BITING THE MAGNAFLUX BULLET

It's not easy to drag your components down to the men with the Magnaflux machine. But once you accept the idea that flaws are better detected than ignored, the rest is simple—and your bike will thank you for it.



PHOTOGRAPHY: ROBIN FRIGGS

● IF YOU READ THE RACER ROAD PIECE you noted frequent references to a process called "Magnaflux," and to our Magnaflux man, Bob Gorsuch. Bob works for the Excello Plating Company in Los Angeles. He has been in the precision inspection business for 23 years, the last five of which have been with Excello, and he has been associated with motorcycles since 1966. He knows what he knows.

"Magnaflux" is the improper terminology for a process used to detect flaws in components. Magnaflux is the name of the company which manufactures and supplies a good deal of the equipment used by automotive, motorcycle and aerospace inspection companies, and Magnafluxing, like Xerox, has become a generic term. The proper one is magnetic particle inspection.

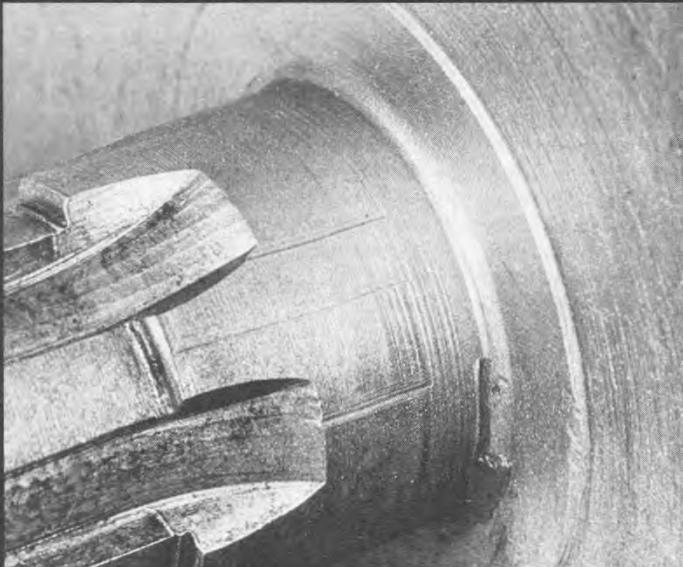
It is not the only service Gorsuch, and Excello, provide. They do shot-peening; penetrant inspection ("Zyglo"); plating; surface treating; aerospace paint application; stripping; and a host of other activities designed to examine and improve the quality of different metal components.

Phil Schilling and I discovered Gorsuch half-way through the 1975 racing season, when it became apparent that some of our Ducati race bike's interior components were becoming mysteriously distressed. Since we availed ourselves of Bob's experience, knowledge and sensitivity about heavily-stressed components, no part that has passed his inspection has failed on the race track—or anywhere else. We have come to rely on him completely to keep our bike, and me, out of harm's way.

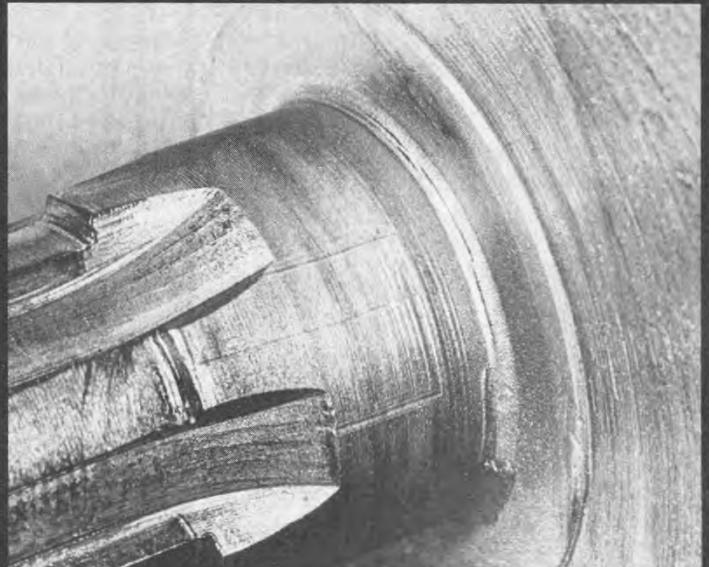
Motorcycle people, despite all sound and persuasive arguments to the contrary, seem to be curiously reluctant to subject their bike's components to the kind of careful inspection commensurate with the kind of use those components will see. Such reluctance comes about for different reasons. The most prevalent is, "I don't want to know about it." To assume a factory-fresh component or body of components to be sound is a comforting, and easy, assumption indeed. You've paid all that money for this crankshaft, or those connecting rods, or those valves. They're new, shiny, and they've left their mark on your wallet. If you subject them to careful scrutiny you're letting yourself in for potentially unattractive news: the part or parts are defective and should be replaced. In most cases, hoping a given part is good (in the absence of any certain knowledge to that effect) is easier to live with than taking a chance that it might be bad. Besides, if it does fail, you're always left with the plaintive cry, "damn junk part. It just broke." It is a cry which generally falls on receptive ears, because we've all cried the same thing.

Second, many find the concept and commerce of professional inspection unappealing. You're paying a man (but not much) to tell you exactly what you don't want to hear. Ultimately it is not his job to give his blessing to sound components; he is paid to find flaws, and although his service may be cheap, it has immediately expensive, and time-consuming, ramifications. The defective part must be replaced, and the new one likewise inspected. If the first was also new, you

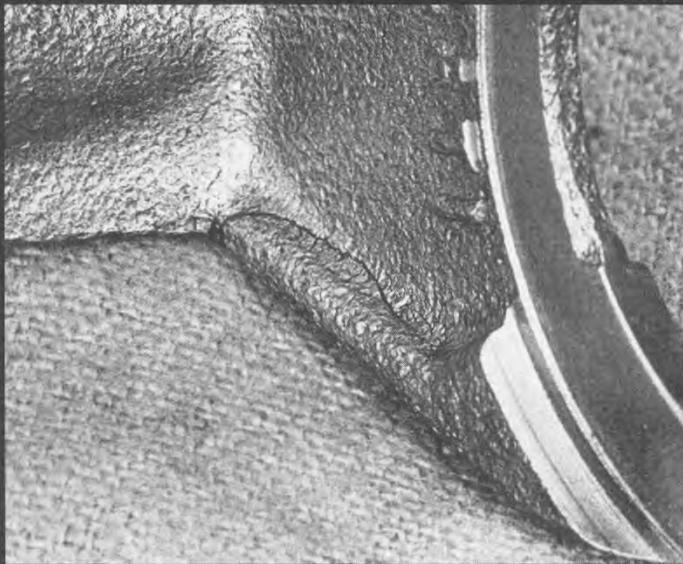
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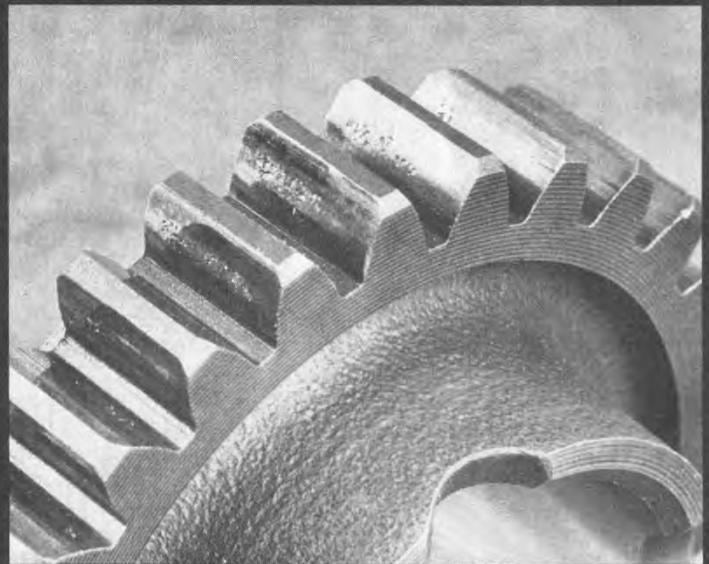
This Triumph crankshaft (above) appears to be in absolutely tip-top condition. The radius between the crank's output shaft and the crank cheek has been peened for clarity and cleanness; the naked eye can see nothing wrong here whatsoever.



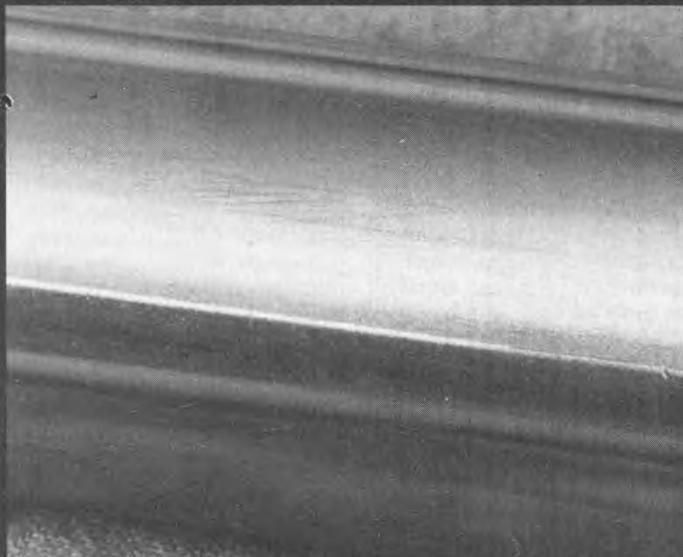
This photograph was taken of the same radius on the same crankshaft—after the magnetic particle inspection process has taken place. The cracks are obvious. If this crank were bolted back into a racing Triumph, it would fail—quickly.



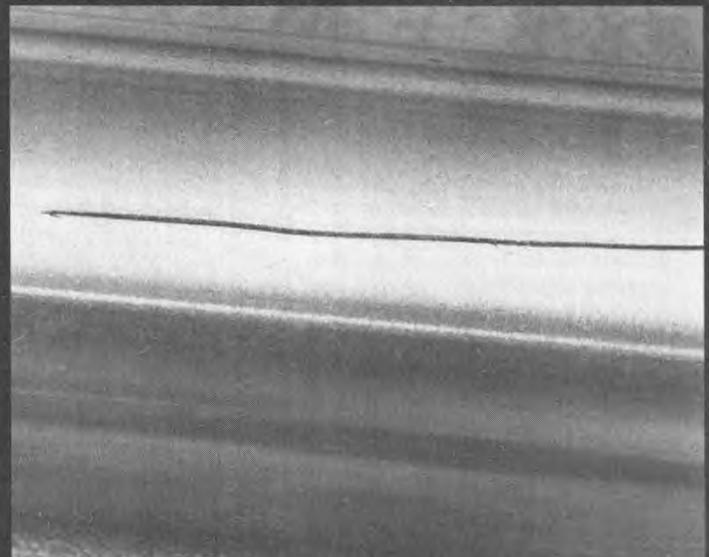
This is a shifter fork from the Neilson-Schilling Production-racing Ducati. The crack you see, likewise discovered by the Magnalux machine, was caused during the manufacture of the part by metal improperly heated during the forging stage.



This problem wasn't revealed by the Magnalux process, but it was explained by our magnaluxer. The case-hardening of these gear teeth is popping off, a condition caused by soft base-metal and case-hardening that didn't reach deep enough.



The shiny shaft you see here is Bob Gorsuch's favorite display item. It is part of the landing gear of a WW2 Hudson bomber, and even the closest bare-eye inspection would reveal nothing wrong; it's round, smooth, and apparently flawless.



Wrong again. After Magnalux a long, deep and dangerous crack is revealed, in the base metal. This shaft was machined out of steel, hard-chrome-plated and then finish-ground to size. It may not have failed in service, but then it may have.

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may not be able to exchange it free for the second.

Then there's the matter of potential guilt. Suppose you have your crankshaft and connecting rods inspected by someone like Bob Gorsuch. He tells you that he has discovered a fatal flaw in one rod. You're left with a decision to make: you either replace the rod, or you live with the knowledge that you have ignored good advice. If inspection is avoided, so too can this possible guilt.

Believe me, I know the feeling, and so does Phil Schilling. After Daytona, we received *gratis* the most beautiful pair of Italian magnesium wheels you ever saw. They were gold, machined to accept the Ducati's front discs and rear disc and cush-hub, and they were light beyond imagining. We wanted in the worst possible way to simply bolt them on and run them. The wheels were manufactured by a reputable builder, and were used in Europe by practically everybody. We suffered. We argued, and discussed. "Suppose we send them out to have them inspected, and they fail?" we wondered. "Suppose we bolt them on, and they fail—on the track?" Finally, gritting our teeth, we shipped those beautiful mag wheels to an aerospace X-ray lab and hoped for the best. We heard the worst. The wheels, those beautiful, sensual things, were loaded with dross, cracks, inclusions and micro-shrinkage. The inspection bill was \$90. In agony we decided against using them, and ordered up a set from Elliott Morris of Morris Mag fame. His wheels are all inspected. We used them. The Italian ones are in my office, serving as decoration. Every time I look at them it hurts.

Once you have learned to accept the often-unpleasant conclusions of a professional inspector, curious things begin to happen. You find, as we did, that components which pass Magnaflux do not break at awkward times. You begin to discover that your inspector will do all he can to salvage questionable components, and to process new ones to guard against their demise. You will find that he will learn more and more about the character of a part the more he inspects it, and in short order will be able to anticipate with great accuracy when it will fail. And you will begin to feel better about wringing your engine's neck, because you will *know*—not simply assume—that the components whizzing around down there are sound ones and not likely to disintegrate under heavy loading.

The particle inspection process itself is

nothing magic, or mysterious. "It'll work on any part that is ferro-magnetic," Bob explained, "any part that a magnet will stick to. You magnetize the part with DC current. At the same time the part is being energized, a liquid is flowed over it that contains iron oxide particles. They're attracted magnetically to any discontinuity in the metal, and show up as a distinct, black line. You have to learn which kind of magnetism to use on which part, and where to look for the crack. Depending on the amperage (as much as 5000) the machine can pick up defects up to 1/8-in. below the surface." For parts made of aluminum, Bob uses penetrant inspection, also known as "Zyglo." The part is bathed in a fluorescent solution, washed, and then inspected under a black light. Wherever the fluorescent solution has penetrated a crack, it shows up hot and clear under the light.

Shotpeening is a process which relieves built-in surface stresses by bombarding the surface with a stream of high-velocity steel or glass particles, leaving tiny, hemispherical dents which pack the metal's surface molecules tightly together. "Surface stresses are what cause cracks," Gorsuch explains. "Nothing else can cause a crack. You incur terrible surface stresses in a part when you manufacture it. When you relieve those surface stresses, you reduce the possibility of a crack starting. People say, 'gee, it's only a *surface* crack.' But that's the worst kind. You can't start a crack on the inside of a part."

We have been hanging around Bob Gorsuch and Excello Plating for more than a year now, and have come to appreciate the wisdom which experience and interest have given him. He makes his living peering at metal parts, knowing where to look for trouble, projecting probable useful life, and prolonging it with all the tools and treatments at his disposal. His enthusiasm for motorcycling makes him doubly valuable; but his connection with our sport has made him suspicious, and skeptical. Here is a sampling of what we have come to call, "Gorsuch-isms":

"A new part is a dangerous part. Ninety percent of the failures I see are caused by parts that are flawed when they are assembled, new, at the factory. I call 'em 'pre-broken parts.' Luckily, most of these parts are designed ten times stronger than they have to be, or there'd be a lot more failures than there are."

"In my opinion there are very few people who know how to do anything right. Most of the ones who do are in the automotive industry. The dummies have graduated to the motorcycle industry."

"Motorcycle people are impressed by things that are bright and shiny."

"Motocrossers break transmissions because the parts are too light to begin with. When a motocross racer brings parts in here I tell him, 'Let's clean 'em up and

leave 'em stock, and get *yourself* in shape.' Don't worry about power, 'cause it isn't going to make any power anyway. Most motocross bikes are made so lousy that the main thing is to get them to last."

"I think the best basic materials are used in Harley-Davidsons. Most other manufacturers use a cheaper material and case-harden it to make it effective. The overall finish on parts is best on Hondas."

"Next to pre-broken parts, most failures are caused by dummy mechanics. The most typical dumb thing a dummy mechanic does is reassemble components without checking them to see if they're dimensionally correct."

Considering that services offered by people like Bob Gorsuch can produce quantum leaps in component durability and reliability, it would be fair to assume said services are expensive. They're not. In fact they are astonishingly inexpensive. Some typical prices, from Excello's own price sheet:

Magnaflux or Zyglo Inspection	
Crankshaft.....	\$3.00 to \$6.00
Connecting rods complete	\$1.25
Pistons	\$1.00
Valves	\$0.30
Rocker Arms	\$0.50
Cam shaft	\$1.00
Complete 5-speed transmission	\$8.50
Shot Peening	
Crankshaft.....	\$7.50 to \$15.00
Connecting rods	\$2.00
5-speed transmission complete	\$10.00
Timing or transmission gears	\$1.00
Bearing cages	\$0.50

If you are halfway serious about either your street bike or your racer, I cannot think of any service or group of services I would more emphatically recommend than those offered by Excello Plating, and if that sounds like a commercial, so be it. And talented as Bob Gorsuch is, he would be the last to suggest that he's the only metal inspector in the world. There are in fact lots of inspection stations in the United States, many of them certified by USAC and NASCAR. If you have difficulty finding your friendly local Magnafluxer in the Yellow Pages, simply ask the most successful automobile mechanic or racer in your neighborhood. If that fails, and you don't live in the Los Angeles area, Bob Gorsuch would be delighted to receive your work in the mail and return it in the mail. The address: Excello Plating, 4057 Goodwin Avenue, Los Angeles, Cal. 90039 or telephone 213-245-3626.

As I said earlier in the story, much of the credit for our Ducati race bike's solid season must go to Gorsuch. He can do the same thing for your bike, whether it's a motocross racer, dirt-tracker, street bike, canyon racer, café racer, Baja racer or play-racer. Count on it.

—Cook Neilson

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