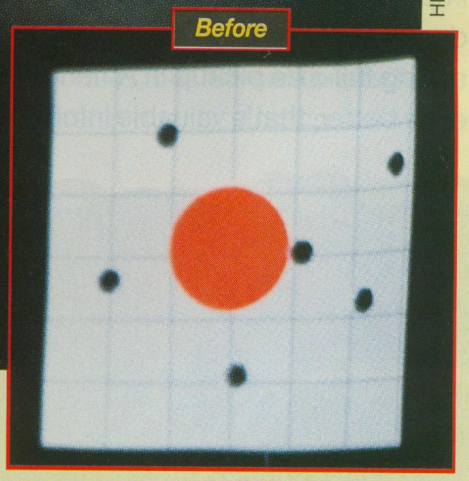
FIRE-LAPPING

How to improve your rifled arm's accuracy by polishing the bore bright and smooth firing abrasive-coated bullets!

By Ross Seyfried

HIGH-SPEED ACTION PHOTOGRAPH BY JIM BROWN



Coating projectiles with special abrasive lapping compound and then systematically firing them through a rifled arm's bore can improve accuracy, as seen in the above "before" and "after" photos.

If there is a bottom line to accuracy, it is the gun barrel, a magical bore with spiral grooves that guides the bullet. The control given a 1-inch-long projectile comes from the first 4 to 30 inches of a flight that may extend to 36,000 inches or more. At the end of what seems, relatively, to be an infinitely long voyage, the bullets from a grand bore may strike an area only slightly larger than the bullet itself. Or, if the bore is a poor one, they may scatter about in a frustrating degree of inaccuracy. Seekers of accuracy coddle their ammunition, train their hands and eyes, bed actions in stocks, adjust cylinder alignment and are forced to stand idly by, placing pure trust in the barrelmaker. We have had to accept whatever accuracy a barrelmaker and installer handed us without hope of improvement...until now. At the end

The author fires his .30-06 Remington from the bench using a Stingless Rifle Rest. Before and after groups were shot to quantify the results of barrel lapping.

PHOTOGRAPHY BY THE AUTHOR

of these pages you will be armed with an almost foolproof way to make your rifle or handgun barrel more accurate.

I'm not sure who invented this process or why they named it fire-lapping. Like most things associated with shooting, nothing is new. I have seen references to the process as early as some of our buffalo hunters. A more accurate name would be bullet-lapping, because fire has nothing to do with the process, unless you consider the fact that we fire the gun to make it happen. In a nutshell, to fire-lap we shoot lead bullets, coated with an aggressive abrasive, right down our pet gun barrels.

Before I describe the magic, let me touch on what fire-lapping *won't* do. Like load development, fire-lapping won't cure other ills. In rifles it won't help bad bedding, crowns, chambers, scopes or mounts. Where handguns are concerned, lapping can't cure the rifle problems (exclusive of bedding), poor cylinder alignment, incorrect throats or big groups caused by the shooter. The "will dos" of lapping are all within the barrel itself.

To best describe the effect of fire-lapping, I will begin by broadly defining what I think would be the "ideal" gun barrel. It will be very smooth, with any "scratches" running down, not across, the bore. The diameter will be uniform or slightly smaller at the muzzle than at the breech. The twist rate will be very uniform, without rapid bumps or changes in the spiral. Finally, the leading edge of the lands (the surface that actually drives the bullet into its spin) will be highly polished and very uniform, without hills and hollows that could momentarily allow high-pressure gas to leak or the hydraulic pressure of the lube on a cast bullet to drop.

What can be wrong with barrels, especially high-production factory barrels, are conditions that are exactly opposite any or all of those of the ideal barrel above. Additionally, possibly the most common mechanical barrel problem occurs in revolvers. This is a choke, or tight spot, in the barrel right under the threads where the barrel is screwed into the frame. The larger the bore, and correspondingly thinner the steel at that point, the more apt the choke is to happen. When this very common disease appears, we have a situation almost guaranteed to detract from accuracy. The bullet is blown out of the cylinder and into the barrel's forcing cone. In a theoretical .44 Magnum the bullet is .430 inch in diameter and enters an ideally .430-inch bore. But right under the threads the bore has been crushed a full .001 inch or more. Whap! Our .430 bullet crashes into a half-inch-long, .429-inch choke. It literally gets sized down and then is blown back into a .430-inch barrel. Gas begins to leak past the bullet, lubrication breaks down and in the most severe cases even a springy jacketed bullet will have a "rattle" fit for the rest of its ride down the bore.

Before fire-lapping, the only hope for a cure was to return the gun to the factory for a new barrel, or to cast a lead slug in the bore, coat it with abrasive and haul it back and forth until the tight spot was gone. This is how most of the finest benchrest barrels are made. With this hand-lapping method done by anyone but the highly skilled barrelmaker before the barrel is fitted to the frame, the probability of ruining the barrel is possibly as high as 90 percent.

Enter fire-lapping. I will be specific in a moment, but about now you are begging for the idea. Take the same .44, coat some unsized .430-inch or larger cast bullets with sophisticated lapping compound (*not sand or valve-grinding compound*), load them over small charges of fast powder and fire 24 of them. Several things happen. The most obvious is that whenever the barrel pushes on this razor-sharp "cutting bullet," the part of the barrel that touches the bullet will be sanded away in microscopic fashion.

The first thing to go is that tight spot under the threads. The lapping bullet is resized just like the regular ones and therefore doesn't apply much force to

This battery of firearms was "fire-lapped" for the author's tests. They include, clockwise from top: a Remington Model 700 in .30-06, Ruger Blackhawk Hunter in .44 Magnum with a Burris scope, a custom .475 Maximum built on a Ruger Bisley and a Ruger Super Redhawk .44 Magnum.

This is the muzzle view of the author's .475 Maximum revolver after fire-lapping, showing the smooth, even finish achieved.

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the rest of the barrel after it hits the tight spot. As each successive bullet cuts part of the tight place away, they more closely match the rest of the barrel until finally the tight spot is gone and the laps uniformly polish the entire length of the bore. At the same time they lean on the leading edge of the lands, honing and polishing them to perfection. If you have ever run a wood plane that cuts off the high spots of a rough board, you can grasp the concept of the lapping bullet. It tends to plane off the tops of tool marks, bumps in the diameter and any abrupt "wiggles" in the rate of twist.

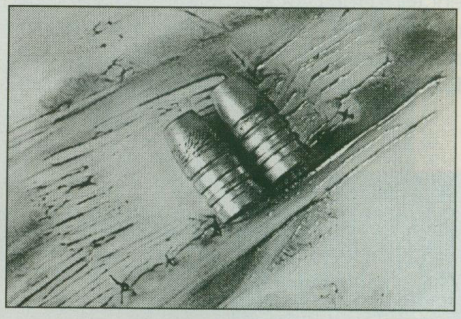
Another positive asset of fire-lapping is directly related to any lap. They are sharpest and largest in diameter at the beginning of their work. The effectiveness of the lapping bullet slightly diminishes as it travels down the barrel. It cuts more aggressively at the breech than at the muzzle and naturally wants to create a tapered bore that grows smaller and therefore increases its grip on the bullet as it progresses toward freedom at the muzzle. Keep in mind we aren't ripping out big chunks; the changes are gradual and almost microscopic in dimension.

At the moment you are armed with enough information to be confused and dangerous. Before you is your favorite handgun or rifle—to lap or not to lap and how to go about it? In the broadest sense, if I had a handgun or rifle and were going to shoot *lead* bullets I would lap. If I had a handgun that was primarily going to fire jacketed bullets and I found a thread-choke in the barrel or could see roughness (tool marks) when I looked in the clean muzzle, or if I just couldn't decide, I would lap. If I had a rifle for jacketed bullets that was properly sighted and bedded and would not shoot 1-inch, three-shot groups, I would seriously consider lapping it.

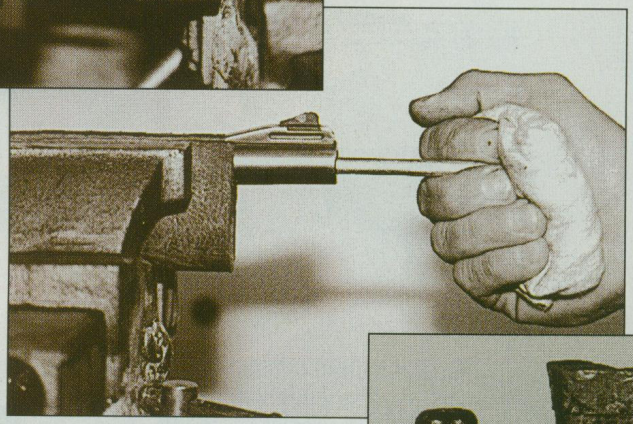
With the decision to lap, what bullet do I use? There is an unbelievably simple solution, the LBT company. They make bullet molds to any size or requirement. To get the ball rolling, send $2 for a catalog to LBT, Dept. GA, HCR 62, Box 145, Moyie Springs, ID 83845. In the catalog are helpful instructions on ordering supplies that cover the spectrum of fire-lapping, lead bullet casting and shooting. They will supply lead slugs to measure your individual barrel, allowing you to order a bullet mold custom-fitted to your individual arm. They also sell fire-lap kits that offer complete instructions and abrasives. If you don't cast bullets, they will sell you small quantities of special "lapping bullets" that you can coat with their abrasives, load and lap your barrel with. Also, if you want to get LBT bullets (ready to load) lubed and sized to fit your gun, they are available from Beartooth Bullets, Dept. GA, P.O. Box 491, Dover, ID 83825. Send them a stamped, self-addressed envelope for the list.

Soft lead bullets are used for the initial barrel testing. I regularly use the swaged-lead pistol bullets from Speer or Hornady. These are nearly pure lead and can be easily driven through a bore. Begin with the first size larger than your caliber; that is, use .45s in a .44, .38s in a .338 or .32s in a .30 caliber, etc. If we are measuring a rifle, single-shot or auto-pistol barrel, we determine the smallest diameter that exists in that bore by pushing a slug all the way through it. While we push the slug through, we also "feel" the geometry of that bore. Chances are the slug will be more difficult to push in some places than others. The difficult places represent smaller diameters, changes in twist or roughness. If, in pushing the slug from breech to muzzle, the force needed is uniform, or gets slightly more difficult as you go, the barrel is a very good one and will need only a little lapping to polish the surfaces. If on the other hand you get clunks and bumps or the slug pushes more easily toward the muzzle, you will need to lap until you get uniformity or increase at the muzzle.

With a revolver we push from muzzle to breech. Here our "slug-force" should remain the same, or get easier to push, as



LBT's bore lapping compound is shown in its container, along with it being applied to lead bullets by the "rolling" process. The abrasive compound smooths and polishes the surface of the bore as bullets are fired.



Bore slugging the author's Ruger Super Redhawk from the muzzle revealed any tight spots, while carefully slugging the forcing cone tells whether or not any "choke" exists at this point.

This lineup shows the various lead "slugs" the author used to determine the bore dimensions of the various firearms used in his testing. From left, these are a Speer .45 lead bullet used to slug a .44 barrel, an LBT tapered slug used to measure the .44's forcing cone and the same type of slug before use and .44-caliber and .30-caliber LBT lead slugs before use.

we near the forcing cone. I'll bet the chances are better than five in ten that you will hit a tight spot right under the barrel threads. With revolvers you also need to push slugs through the cylinder throats. The goal here is to be sure that the throats are as large as or slightly larger than the bore. Quite often you will find, for example, .451-inch throats and a .452-inch up to .454-inch bore. When this happens you cannot help the barrel by fire-lapping, because the throats will size the bullets down so they cannot "work" on the barrel. Also, a revolver with this geometry is very apt to be inaccurate. It may shoot jacketed bullets okay but will usually be miserable with lead. If you find tight throats, they must be enlarged to utilize fire-lapping. How to do that is another subject covered in LBT's fire-lapping instructions.

With the measuring done you select a bullet that is larger than the groove diameter. One thousandth of an inch is a good number for rifles; handguns may want .002 inch or even .003 inch more for best results. That is, we would lap the normal .430-inch .44 Magnum barrel with .432-inch to even .433-inch bullets. The key is that the bullet cannot cut unless it is at least as large as the diameter of the metal we want to remove from the barrel. If it is larger, the bore sizes it down to perfection.

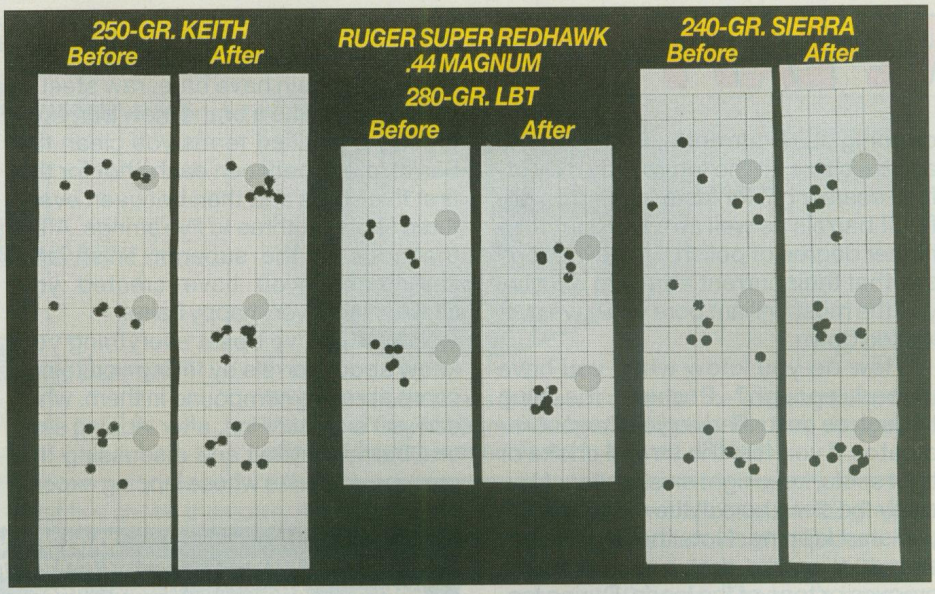
To make lapping bullets, use an unsized and unlubricated cast bullet coated with abrasive. The bullet should be soft; that is, about 10 to 14 on the Brinnell hardness scale. As an unsophisticated guideline, they should cut easily with your thumbnail. A hard cast bullet or jacketed bullet will spring back from any tight spots and actually follow the uneven diameters rather than cutting off the high spots. To coat the bullets, smear some compound on a piece of glass or steel and roll the bullets in the goo with another piece of glass or steel, or just smear the grease grooves full with your fingers and load 'em.

To fire-lap the bore of a .22 rimfire arm, the LBT lapping compound is applied directly to the tip of the bullet, like whipped cream on a sundae!

The loads for lapping use very small charges of fast powder. I use Bullseye, but other similar propellants will work. Use just enough to spit the bullets out of the barrel. Normally 1.5 to 2 grains is right for a .44 Magnum and 2 to 4 grains for big rifle cases. The gun will just pop and you can see the bullets fly through the air. A word of caution: It is possible to stick a bullet in the barrel with insufficient powder. I fire each shot deliberately at a target or dirt bank so that I can *see* each bullet strike. If there is any doubt about the bullet getting out of the barrel, I stop, *unload* and check the barrel to be sure it is clear before I fire another shot.

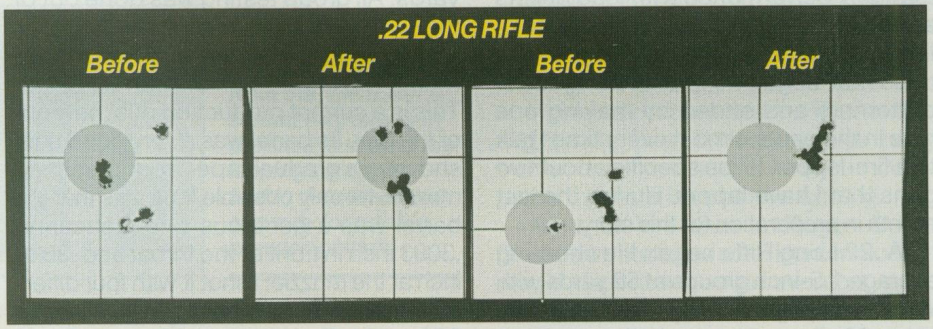
I seat bullets in a regular seating die but push them in deeper than normal. With straight-wall pistol cases I push the complete bearing surface inside the case. This cuts the capacity down, which makes the powder light more easily and, most importantly, keeps most of the messy abrasive away from the chamber. As you fire-lap, you will get grit in the chamber and it will become difficult to load the gun. When things get sticky, stop and clean the chamber or chambers with solvent and carry on.

How much shooting does it take? A good, uniform rifle barrel will probably be lapped and ready to go in 20 shots or less. A rough or lumpy one may take 50. Handguns seem to take more shooting. With the average production barrel that probably has some thread choke, using the LBT medium grit, 50 shots may be a minimum and up to 200 rounds may be necessary to reach perfection. I have found different barrels respond differently to the process. Also, experiments are



Fire-lapping the Ruger Super Redhawk .44 Magnum resulted in these enhanced groups fired with three different bullet styles/weights.

Bullets used in the .44 Magnum accuracy tests before and after fire-lapping include this lineup of jacketed and cast lead projectiles.



This photo shows the accuracy progression of a .22 LR rifle subjected to fire-lapping. The initial improvement was after firing 20 rounds; final group result was after 40 rounds of lapping bullets had been fired.

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ongoing. LBT currently uses only one abrasive size. In the future they may offer a coarser grit for faster cutting on difficult barrels as well as a finer grit for a higher degree of polish. However, I can say that their current abrasive will give you the most brilliant bore you have ever looked down.

How do you know when you have lapped enough? Pushing the slug through as described earlier is a good indicator. If you feel the thread choke or tight spots, keep right on shooting. Also, study the clean bore at the muzzle before you start lapping. Note the usually present tool marks that run across the grooves or tops of the lands. During lapping, view the bore from time to time. As these marks disappear you are almost done. You can also lap for a few shots and then test for accuracy. When you reach the potential you want, that is a good time to stop.

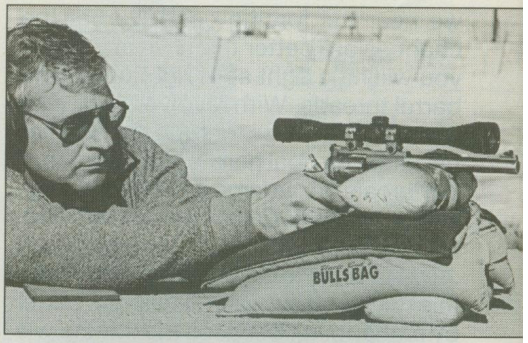
On the subject of cleaning, before you start lapping you want the barrel perfectly clean. Get all of the lead or jacket fouling out so that the lap works on the steel and not the fouling. It is a good idea to clean the bore every 10 or 20 shots during the lapping process to be sure no leading is building up. If the barrel is leaded it will inhibit the lapping process. This is the main reason for the very low velocity. You are shooting the opposite of lubed bullets and they can leave lead in the bore if driven too fast. When you are finished, thoroughly clean the bore and chamber.

I find that when shooting jacketed bullets it is helpful to "break-in" the barrel after lapping. When the lapping is finished you again have bare, raw steel in the bore just like a brand-new barrel. In grossly simplified terms you clean the barrel *totally* between each shot for the first five shots and then between every three shots for three to five strings. After that, due to the superior finish and smoothness you have created you should have a very happy barrel!

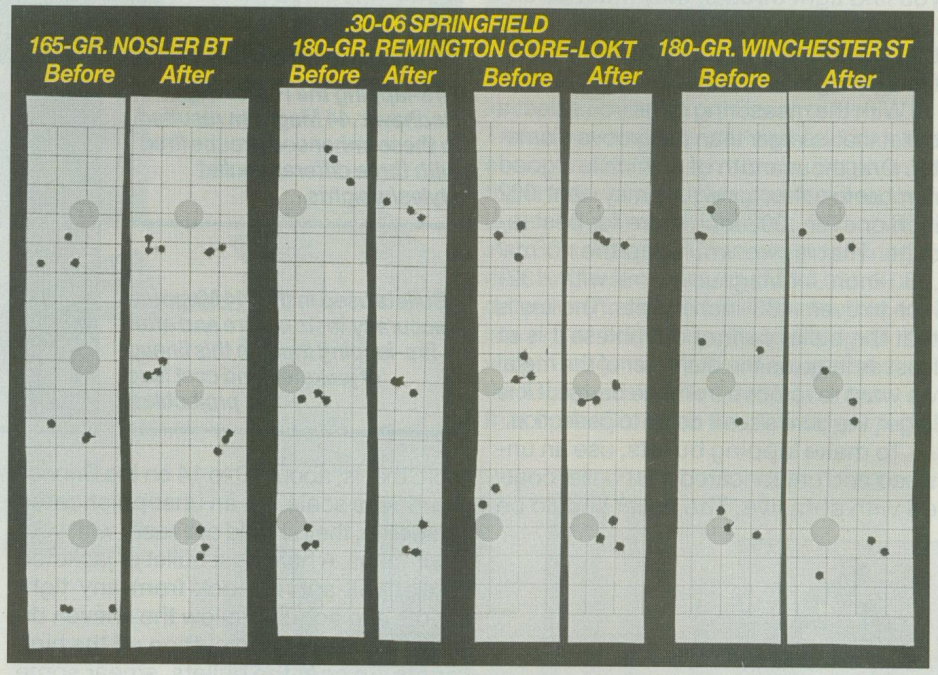
Now that I've upset everything you know about barrels by telling you to put sharp abrasive compound in them, what can you expect? First, after lapping several barrels myself and discussing the process with folks whose lapping experience numbers in hundreds of barrels, it seems almost impossible to hurt a barrel. Now I'm not going to tread on the ground of benchrest barrels that shoot groups in the sub-quarter-minute category. They might improve with fire-lapping, but I don't know. However, with ordinary barrels the worst results I have obtained left accuracy the same as before lapping. Quite often accuracy with jacketed bullets shows marked improvement, and regularly performance with lead bullets appears to be a miracle after fire-lapping. I hear numerous reports of handguns and rifles that began as improved-cylinder patterners and ended by making one hole in the paper almost every time I talk to a fire-lapper. I'll be specific about five guns that I have lapped during the last month in preparation for this story.

A .22 Long Rifle began life shooting average 1.5-inch groups at 50 yards with Winchester high-velocity ammunition. To lap a .22 you use low-velocity ammunition and dip the nose of the bullet in the compound so that it looks like a Dairy Queen sundae. Carefully chamber the round and fire. I lapped the rifle for 40 shots, testing the group after each ten rounds. It showed a regular progression, gradually grouping closer and closer, until after the 40 laps and 100 rounds of normal ammunition to "settle the barrel down" all five shots regularly touch at 50 yards. All group testing was done out of the same carton of ammunition.

I bedded the action of a Remington Model 700 .30-06 with the barrel floated. This is a current production rifle, new out of the box. Its barrel was a very good one, showing a gradual taper from breech to muzzle. Its only possible fault was that the barrel was a generous one measuring .3093 inch in front of the throat and .3085 inch at the muzzle. I shot it with four different loads prior to lapping: WW Silvertip 180-grain, Remington 180-grain Core-Lokt, 168-grain Hornady Frontier Match and a handload with 165-grain Nosler Ballistic Tip bullets over a maximum



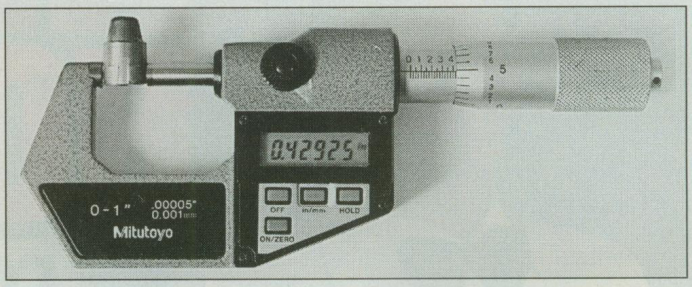
Firing the Super Redhawk from the bench using an Uncle Bud's Bulls Bag, the author laps its bore using specially prepared bullets treated with lapping compound.



The author's .30-06 Remington Model 700 also responded to fire-lapping, although the results varied somewhat by bullet type.

Rounds used in the fire-lapping tests included this lineup of centerfire handgun and rifle cartridges, along with the .22 rimfire. Any firearms barrel will respond well to the lapping process, regardless of type.

ACCURACY TABLE BEFORE AND AFTER LAPPING		
BULLET/LOAD	BEFORE	AFTER
REMINGTON 700 BDL .30-06		
	AVERAGE 100-YARD GROUP (in.)	
Winchester 180-gr. Silvertip*	1.9	1.9
Remington 180-gr. Core-Lokt*	0.9	1.1
Hornady 168-gr. Match*	1.0	1.0
165-gr. Nosler	1.4	.67
RUGER BLACKHAWK HUNTER		
	AVERAGE 50-YARD GROUP (in.)	
Sierra .4295-inch	2.9	2.7
LBT .4315-inch	2.5	2.1
Keith .429-inch	2.6	2.9
RUGER SUPER REDHAWK		
	AVERAGE 50-YARD GROUP (in.)	
Sierra .4295-inch	2.9	1.9
LBT .4315-inch	2.1	1.1
Keith .429-inch	3.9	2.1
*Factory load		



This micrometer shows the measurement of the lead slug taken from the bore of the .44 Magnum before fire-lapping. The bore dimension after fire-lapping was increased to an even .430 inch.

charge of H-414, with the bullets seated .020 inch off the lands. This was a very accurate rifle. You see the table of group size before and after. The real surprise was that my "accuracy" handload didn't perform as well as two of the factory loads with a modest 1.4-inch average. However, after lapping, where the factory loads performed the same, the rifle fell in love with the handload. I shot six groups with it after lapping; the largest was .75 inch and the smallest was .40 inch! Incidentally, all ammunition, before and after, came out of the same box, and all of the handloads were assembled at one loading on my Dillon 550 prior to any shooting. I lapped this barrel with 110-grain .32 Magnum bullets sized .310 inch for only 20 shots. This supports my feeling that it is hard to hurt even a very good barrel. Now with loads it likes, it takes a good target rifle to keep up with this out-of-the-box sporter. The one slight negative that I noticed was that the barrel did seem to heat up rapidly with full-power loads right after lapping. This told me that minute quantities of abrasive remained imbedded in the barrel and elevated the friction level for about 15 shots. A brief break-in and cleaning procedure returned the condition to better than normal.

Next I attacked a .475 Maximum revolver that could best be described as a dog...with bad breath and muddy feet. Its accuracy and velocity performance were poor and the bore leaded terribly.

This is the .44 Magnum lapping round and its bullet. Note that the bullet is seated very deeply in the case to control the lapping compound and to decrease case capacity for reliable powder ignition.

Before lapping, the cases would seize in the chamber at 1,400 fps, where normal performance levels should have been 1,450 fps for working loads. Accuracy was about 6 inches at 50 yards for the first five shots; thereafter it was anyone's guess because the grooves were full nearly to the tops of the lands. Its bore was tight, measuring a uniform .4745 inch without any thread choke. Relatively deep tool marks were visible on top of the lands. After 50 lapping shots, all but the deepest marks were gone and the muzzle had opened up nearly .001 inch, while the breech end was even larger. It had a nice uniform taper from forcing cone to muzzle. After lapping, loads that developed 1,480-fps velocity extracted perfectly and only very minor leading occurred on the lower half of the bore. Groups were normally horizontal strings about 1½ inches high

Soft swaged-lead handgun bullets can be used to slug barrels to determine interior measurements. Use the next larger caliber size (i.e., .45 in .44, .32 in .30) for correct results.

by 4 inches wide at 50 yards. The gun wanted to shoot. Close examination revealed that the cylinder timing left the chambers misaligned; the bullets were hitting the right side of the forcing cone. Time didn't permit a rework, but slight leading on one side of the bore and stringing seem consistent with the misalignment. Even if I can't make it any better, it is like a whole new gun compared to what it was before lapping.

Next in line was a Ruger Super Blackhawk stainless steel Hunter model. I would describe it as an average, good shooter. I tested it and a Super Redhawk with three different bullets: Sierra 240-grain jacketed .4295 inch; LBT 280-grain wide flatnose-shape gas check sized to .4315 inch; and 250-grain Keith sized to .429 inch. All were loaded on 22 grains of H-110 in Federal cases with Federal #155 primers. Groups ran between 2 and 3 inches at 50 yards. The gun's bore was smooth and mostly uniform with a very slight (less than .001 inch) thread choke. I lapped it 50 shots, which made almost no dimensional change in the barrel but did remove almost all of the choke and polished the surface visibly. (This is one of those guns that may need more lapping to bring out its full potential.) After lapping, the accuracy did not change significantly. Leading was reduced and the velocities of all loads showed some increase. The load with Sierra bullets had the greatest, with an average increase of 27 fps.

Finally I lapped one of my favorite bullet-testing revolvers, a Super Redhawk with a 9½-inch barrel. It was usually reasonably accurate with almost anything I put through it. Its barrel geometry was interesting: .430 inch from muzzle to the threads, .429 inch under the threads and then a big portion of .431 inch from threads to the forcing cone. I lapped it 100 shots using .4315-inch bullets. After lapping, this one was a real eye-opener. Because of the generous bore size, I expected the jacketed Sierra bullets to suffer and the undersized (.429 inch) soft 12 BHN Keith bullets to go wild. It cut the Sierra groups by 30 percent and chopped the Keiths by almost 50 percent. The LBT bullets, which fit the barrel, fell from an extremely accurate 2.1-inch average to an awesome 1.1-inch average at 50 yards.

Keep in mind that I did not try to extract maximum accuracy out of any gun after lapping. I simply shot the same ammunition before and after. It wouldn't surprise me to see that Super Redhawk turn in groups at 100 yards that would make most sporting rifles run and hide, with ammunition specially made to its liking.

The above is certainly not a definitive work. We are looking at the tip of the lapping iceberg and will learn more in the future. At very least we are no longer slaves to our barrel makers. A firearm's accuracy is now almost completely in our hands.