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EDITION

PRECISION ARMS WORKSHOP

AND THE AMERICAN GUNSMITH ARCHIVE

A TECHNICAL JOURNAL OF CRAFT, REPAIR & RESTORATION

01

ARCHIVE ISSUE NUMBER

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ATI GALEO (GALIL ARM) FIX

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ORIGINAL METHODS. MODERN ACCESS.

ARCHIVE EDITION 205

DIGITAL ARCHIVE EDITION

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MACHINING

Tormach Plasma Table

BY AMERICAN GUNSMITH EDITORS JANUARY 2021

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Tormach Inc. out of Waunakee, Wisconsin is known for their compact and affordable Computer Numerical Control machines that are ideal for gunsmiths, research and development, education, short run production, or entrepreneurs with an idea. The company has added a plasma table to its CNC equipment lineup. The 1300PL CNC Plasma Cutting Table features travels of X=50", Y=51.5", and Z=3.9".

The table can easily accommodate 4' x 4' sheets of metal and comes standard with a host of premium features, including a floating head with digital torch height control, standard breakaway torch with collision detection, closed-loop servo motors for reliable accuracy and fast speed (1,000 IPM travel, 400 IPM cuts) and acceleration (30 inches/sec/sec), rack and pinion drive, modular electrical system with fully replaceable control cables, integrated water table mounted on sliding rails, ideal for cutting larger parts, and a material picker with pre-loaded speeds and feeds.

The 1300PL allows direct import of DXF (Drawing Exchange Format) files that are commonly used with Autodesk programs such as Auto CAD and other Computer Aided Design software. Operations are con-

trolled by the user-friendly Tormach Path Pilot control software, which can be learned online at hub.PathPilot.com/about. The unit is lift gate ready and no forklift is required for delivery.

Tormach sells the unit at an everything-but-the-torch starting price of about \$14,000 and recommends a Hypertherm (Hypertherm.com, torch purchased separately for use with the 1300PL. Alternatively, entry-level 1300PL packages including the torch, which features Digital Torch Height Control and a magnetic breakaway safety feature with collision detection, start at \$17,150. The 65 amp plasma cutter works well for cuts up to one-inch thick material and the table can hold up to 750 pounds.

Jason Pulvermacher, Technical Product Support at Tormach, says "The 1300PL has become the most used machine at Tormach's facility. Everyone wants a sign or apiece of art. It's so easy to make something with it and it's a great machine for prototyping." Tormach has produced an overview video on the 1300PL: [You Tu.be/Ib F3SGy Zpd U](https://www.youtube.com/watch?v=F3SGyZpdU) and the company can be contacted at Tormach.com or

MACHINING

ATI Galeo (Galil ARM) Fix

BY BRIAN R. SMITH JANUARY 2021

ORIGINAL PP. 3-7



Above: American Tactical, Inc. assembles surplus Galil ARM parts kits with provisions for a bipod onto milled receivers of their own manufacture. The assembled Galeo rifles are fitted with a side-folding stock, available with either wood or black polymer handguard panels.

ORIGINAL ARCHIVE IMAGE • PERMISSION CONFIRMED



Left: Common Galil magazines include the 35-round polymer OrLite (left), the 35-round steel (center), and the 30-round polymer Tapco Intrafuse (right).

ORIGINAL ARCHIVE IMAGE • PERMISSION CONFIRMED

Working the ATI Galeo and addressing magazine problems. by Brian R Smith American Tactical, Inc. makes a Galil-style rifle called the Galeo. This 5.56mm rifle is a semi-automatic clone of the ARM version of the Galil using newly-machined receivers, barrels, and parts from demilitarized rifles. Some Galeo rifles have issues with magazine fit and this article describes the problem and possible remedies I had a chance to find after a customer brought in his Galeo after it exhibited a couple of functionality issues.

The Galil, invented by Ysrael Galil and made by Israeli Military Industries, was based on the Valmet Rk62 military rifle, which itself was closely derived from the AK-47. The Galil entered service in 1972, replacing the FN-FAL as the Israeli main battle rifle. Variants include the AR (Automatic Rifle), ARM (Automatic Rifle Machine Gun) with bipod, and SAR (Short Automatic Rifle). Aside from Israel, Galil rifles were adopted in varying quantities by dozens of countries, with South Africa being the most referenced.

Semi-automatic IMI-made Galil AR and ARM rifles have been imported beginning in the mid-1980s by Magnum Research, Action Arms, and Springfield Armory, Inc. New manufacture receivers assembled with parts kits were produced by assembles sur-

plus Galil ARM parts kits with provisions for a bipod onto milled receivers of their own manufacture. The assembled Galeo rifles are fitted with aside-folding stock, available with either wood or black polymer handguard panels. Century Arms (Golani) and now ATI with its Galeo.

ATI Galeo rifles are assembled on newly-made receivers using new production barrels and the rest of the components sourced from ex-Galil ARM parts kits from which usable, Good+ condition parts are selected. The metal bits on the completed Galeo exhibit a finish that at a glance visually appears to be gray-green phosphate, but glossy, and I believe it to be a flavor of Cerakote or a similar coating product. The tubular aluminum folding stock has a darker, almost black coating with the appearance of nitriding.

Not saying it is nitriding; it just looks that way. The ATI Galeo ships with one Tapco Intrafuse 30-round polymer magazine, which functioned 100% with brass and steel cased 5.56 and .223 ammunition. The customer's complaint was that only one of six surplus steel Galil magazines he had obtained would latch in place and function. The other five would either not fully latch or would partially latch and fall out if sharply nudged forward at the bottom end.

Writing parenthetically for a moment, with the recent business decision of Freedom Group/Remington Outdoor to curtail operations of the former Tapco subsidiary (along with Bushmaster, DPMS, and others), whatever Tapco Galil magazines that remain in the primary and secondary markets are all that will be available. No more are being made and there are no suitors for what remains of the Tapco operating unit.

For owners of any 5.56-chambered Galil rifle, it becomes advantageous for still-available surplus steel Galil magazines to fit and function in their rifles. For true IMI Galil and Century Golani rifles, surplus steel magazines have not been widely reported to be problematic.

Not so with the ATI Galeo; American Tactical, Inc. designed it to use the Tapco Galil polymer magazine and put a cautionary disclaimer on their website against the use of surplus steel magazines, saying in so many words that the Galeo is not warranted to function using steel magazines: "Due to variations in manufacturer specifications and wear conditions, American Tactical cannot guarantee these rifles will operate with surplus Galil magazines."

If you are attempting to use surplus magazines in your Galeo rifle, American Tactical recommends perform-

ATI GALEO (GALIL ARM) FIX CONTINUED

ORIGINAL PAGE 4



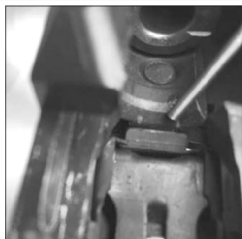
Far left: Punch tip points to the front tab of a steel Galil magazine tucked under the thin lip of the feed ramp with the magazine locked into place. Left: A steel Galil 35-round magazine with a front tab too high to fit beneath the feed ramp lip, preventing the magazine from locking into place.

ORIGINAL ARCHIVE IMAGE • PERMISSION CONFIRMED



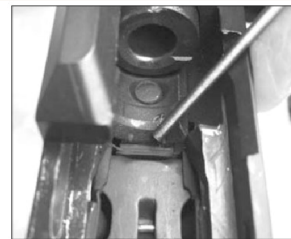
Far left: Comparison of the front tab on the Tapco (left), Orlite (center), and surplus steel (right) magazines. The bottom edges of the front tab are aligned at the same elevation, which highlights the higher tab of the Orlite, the reason this and the surplus steel magazines did not fully enter the magazine well. Left: Two steel 35-round magazine front tabs compared; looking closely, one can see that the tab on the left magazine is noticeably thicker than the tab on the magazine on the right. The tab on the left is 0.210" high, whereas the tab on the right is only 0.176" high. The higher tab on the left interferes with the ATI Galeo's feed ramp, preventing insertion and lock-in.

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Far left: Punch tip points to the front tab of a steel Galil magazine tucked under the thin lip of the feed ramp with the magazine locked into place. Left: A steel Galil 35-round magazine with a front tab too high to fit beneath the feed ramp lip, preventing the magazine from locking into place.

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ORIGINAL ARCHIVE IMAGE • PERMISSION CONFIRMED

Far The bottom edges of the front tab are aligned at the same elevation, which highlights the higher tab of the Orlite, the reason this and the surplus steel magazines did not fully enter the magazine well. The tab on the left is 0.210" high, whereas the tab on the right is only 0.176" high. The higher tab on the left interferes with the ATI Galeo's feed ramp, preventing insertion and lock-in. ing general maintenance and cleaning of the magazine before attempting to operate it.

Failure of a Galeo to operate with a surplus magazine is not covered under warranty, as we only recommend using new manufactured US made magazines with your rifle." A second reason for ATI to discourage surplus magazines is 18 USC Section 922r which requires a minimum number of US-made parts in a semi-automatic rifle "that has no sporting purpose" assembled using foreign parts kits.

The Tapco magazine counts as three of those critical US-made parts and use of a steel surplus magazine might cause the owner some degree of legal headache if the BATFE ever decided to start prosecuting 922r violations. But this isn't the place for debating 922r. The

manufacturer's position and the law notwithstanding, my customer is the owner of a local tool and die shop and has access to metal 3D printing apparatus.

Being aware of the law he either produced himself or purchased additional parts necessary to increase the US-made parts count of his rifle by three so that surplus steel magazines could be used. He felt that "a Galil should be able to use real Galil magazines." In theory I agree, but in practice with his ATI Galeo, surplus steel magazines appeared to be problematic and the reasons for this are understandable.

First, it is reasonable to expect demilitarized parts kits to have varying degrees of use and wear, and perhaps individual parts may have been fabricated by more than one supplier. The Galil entered Israeli service in 1972 and was adopted in both 5.56x45mm and 7.62x51mm versions. The machinery used to manufacture parts may have included early CNC technology using either magnetic media or paper tape, but the machining and precision at that time was likely not comparable to that which is possible today, 50 years on.

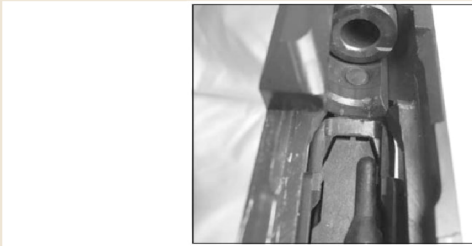
Second, the ATI Galeo receivers are machined from a billet using modern CNC equipment, so the level of precision in the ATI receiver can be expected to be better than that of the components in the parts kits ATI has secured. Even though the Galeo rifle appears to be very well made, there is the potential for some portions or features to be less than nominal tolerance-wise.

In other words, when every component is newly manufactured, a higher level of precision of the individual pieces and the sum of those parts can be expected. Assembling used parts to anew receiver? That's more of a challenge to perform if the end result is to be a fully functional and dependable firearm, and would likely require some individual fitting.

Disassembly Regarding the customer rifle, in order to troubleshoot the problem the Galeo needed to be disassembled so that the magazine well could be viewed from above as well as from a magazine eye's view underneath. Fortunately, disassembly is almost pure AK. First, remove any mounted magazine and pull the vertical bolt carrier Far

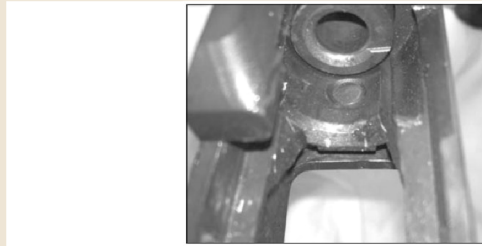
ATI GALEO (GALIL ARM) FIX CONTINUED

ORIGINAL PAGE 5



Far left: The very high front tab on the polymer Orlite magazines also interferes with the feed ramp lip in the same manner as some of the steel Galil magazines with the higher front lip. Left: The ATI Galeo's feed ramp shown from above, held in place by a rivet directly beneath the chamber mouth. Below the sharp feed ramp lip is the front of the magazine well opening. The front lip of the magazine rests in the space between the magazine well opening and the feed ramp lip.

ORIGINAL ARCHIVE IMAGE • PERMISSION CONFIRMED



Far left: Underside of the feed lip,

ORIGINAL ARCHIVE IMAGE • PERMISSION CONFIRMED



Far left: Underside of the feed lip,

ORIGINAL ARCHIVE IMAGE • PERMISSION CONFIRMED



Far left: Underside of the feed lip,

ORIGINAL ARCHIVE IMAGE • PERMISSION CONFIRMED

Far Below the sharp feed ramp lip is the front of the magazine well opening. The front lip of the magazine rests in the space between the magazine well opening and the feed ramp lip. handle to the rear to withdraw the bolt from battery so that the chamber can be verified to be empty. Next, press in the recoil spring catch button in the rear of the top cover and lift the top cover off. Push the recoil spring catch button forward to clear its slot in the rear of the receiver.

Lift the recoil spring assembly up and withdraw it out of the recess in the bolt carrier. Slide the bolt carrier to the rear and lift the carrier upward and out of the slots in the rear of the receiver rails. Withdraw the piston from the gas tube. The gas tube is loose and retained by slots at the rear, the gas block at front, and also by the top cover when assembled, so once the bolt carrier is removed the gas tube can be slipped rearward about an inch to clear its slots and the gas block.

No further disassembly is necessary at this point but the handguard can be removed by rotating the front handguard retainer lever to release the front retainer, and then by sliding the retainer forward to release the handguard. For detailed disassembly of the

Galil/Galeo fire control group, refer to online posts or videos. I started the discovery phase of the customer's magazine problems by inserting the empty Tapco Galil polymer magazine that came with the rifle.

The front tab readily engaged the gap between the receiver and the cartridge feed ramp's lower edge. The magazine was easily rotated to the rear, pivoting up so that the rear tab snapped into place, retained by the magazine catch. Removal was just as simple, pressing the magazine catch forward which unlocked the rear tab, and then rotating the magazine down and forward so that the magazine could be withdrawn from the magazine well in the receiver.

Next, I took up the one surplus steel magazine the customer said would fit and lock into place. It did, similar to how the Tapco magazine latched in and could be removed. A second surplus steel Galil magazine would not fully rotate to the rear and up. The magazine catch lever remained forward instead of snapping back as it would on a latched magazine.

With that magazine inserted as far as it would go and held in place by friction of whatever interference was being caused, I examined how the magazine fit in the magazine well and in relation to other components in the vicinity or in contact with the magazine. That troublesome steel magazine was removed and the steel magazine that fit properly was reinserted. I paid close attention to where, and with what, it made contact in contrast.

The principal cause of the steel magazines not inserting was the height of the front tab on the upper front wall of the receiver. In other words, the top surface of the front tab projected up so far that it interfered with the bottom edge of the feed ramp. On the steel magazine that fit properly, the height of the front tab was 0.176". The tab height on Far This thin leading edge precludes any modifications to this particular weapon, and modifications were elected to be made to the magazines instead.

The mag release lever's guard is to the immediate right of the magazine release lever, and is a characteristic feature of the Galil and Finnish Valmet rifles from which the Galil was copied.

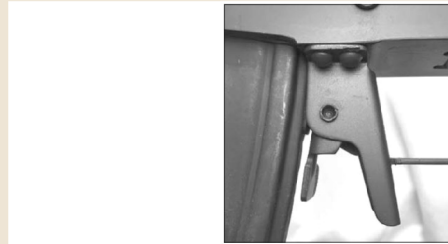
ATI GALEO (GALIL ARM) FIX CONTINUED

ORIGINAL PAGE 6



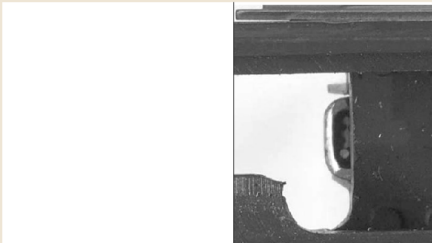
Far left: The Galeo's magazine release lever with a steel Galil magazine whose front tab does not fit properly under the feed ramp leading edge. The magazine is not latched and bumping the lower rear of the magazine with a fist knocks the magazine out of the magazine well. Left: The upper edge of the customer's Galeo magazine catch would stick in the deep spot weld just above the rear tab when removing the magazine from the weapon. Rather than polish each of those welds on the customer's steel magazines, the sharp corners of the magazine catch upper edge were lightly rounded and then polished prior to refinishing.

ORIGINAL ARCHIVE IMAGE • PERMISSION CONFIRMED



Far left: The Galeo's magazine release lever with a steel Galil magazine whose front tab does not fit properly under the feed ramp leading edge. The magazine is not latched and bumping the lower rear of the magazine with a fist knocks the magazine out of the magazine well. Left: The upper edge of the customer's Galeo magazine catch would stick in the deep spot weld just above the rear tab when removing the magazine from the weapon. Rather than polish each of those welds on the customer's steel magazines, the sharp corners of the magazine catch upper edge were lightly rounded and then polished prior to refinishing.

ORIGINAL ARCHIVE IMAGE • PERMISSION CONFIRMED



Far left: Corners of the upper edge of the magazine catch after polishing and prior to refinishing. Following this improvement, the rounded magazine catch readily and easily rode over the spot welds without sticking as the magazine was removed. Left: The dark area between the two rivet heads is bottom of the receiver where later-production Galeo rifles are apparently machined thinner to allow magazines to lock in place such that more of the cartridge case head is impacted by the bolt face to successfully strip cartridges out of the magazine.

ORIGINAL ARCHIVE IMAGE • PERMISSION CONFIRMED



Far left: Corners of the upper edge of the magazine catch after polishing and prior to refinishing. Following this improvement, the rounded magazine catch readily and easily rode over the spot welds without sticking as the magazine was removed. Left: The dark area between the two rivet heads is bottom of the receiver where later-production Galeo rifles are apparently machined thinner to allow magazines to lock in place such that more of the cartridge case head is impacted by the bolt face to successfully strip cartridges out of the magazine.

ORIGINAL ARCHIVE IMAGE • PERMISSION CONFIRMED

the magazines that interfered with the bottom edge of the feed ramp was as high as 0.210". Thirty-four thousandths higher. That amount of variation in surplus steel Galil magazines was surprising, but giving it some thought, IMI-made Galil rifles probably were constructed such that the variation in the height of the front tab was tolerated. It's inconceivable that surplus steel Galil magazines didn't fit Israeli-made Galils, unless these were rejects... but one must work with what one has. So, what to modify?

Because the Tapco and steel surplus magazines functioned well, it did not make sense to modify the receiver, the feed ramp, or anything else on the otherwise-functional rifle when the problematic six of seven steel surplus magazines could be made to fit. Since a front tab height of 0.176" would work, the upper ends of the higher front tabs on the problem magazines were carefully ground down using a narrow-width fine circular stone to the point that they no longer interfered with the bottom edge of the feed ramp.

The ground areas were polished with abrasive-filled rubber polishing tips and the polished areas were touched up with Eastwood Zinc Phosphate (#10281Z, Eastwood.com, which is actually a paint formulated to cosmetically look like a dark gray zinc phosphate. Acetone was used to degrease the ground and polished areas before dabbing on the coating. As it happened, the Eastwood Zinc Phosphate was a near-perfect visual match for the OEM phosphate on the surplus magazines.

Even with properly-sized front tabs, the magazine catch would not fully engage on the rear tab on three of the six steel magazines. That is to say, the bottom end of the magazine catch lever remained forward, almost against the rear wall of the magazine, instead of snapping back toward the mag catch guard and trigger guard. After taking measure- Far The magazine is not latched and bumping the lower rear of the magazine with a fist knocks the magazine out of the magazine well.

Rather than polish each of those welds on the customer's steel magazines, the sharp corners of the magazine catch upper edge were lightly rounded and then polished prior to refinishing. ments, it was found that the rear tab was thicker on that magazine. The fit of the magazine in the magazine well confirmed this; with the bolt and carrier installed, the bottom edge of the bolt barely caught on the case head of a dummy cartridge in the magazine.

So, the upper surface of the rear tabs on the affected magazines was carefully ground-and-tried until the magazine catch snapped to the rear when the magazine was seated in the magazine well. Again, the ground surface was polished, degreased, and coated with the Eastwood product.

All seven modified magazines were loaded with 30 rounds of Federal XM193 5.56 ammunition and Far Following this improvement, the rounded magazine catch readily and easily rode over the spot welds without sticking as the magazine was removed.

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22 Pistol Grip Screw 23 Magazine Catch Spring 24 Mag Catch Pivot Pin 25 Trigger Spring 26 Pistol Grip Base 27 Grip Retaining Pin 28 Left Selector Lever 29 Selector Link Rivet 30 Selector Lever Link 31 Right Selector Lever 32 Receiver 33 Barrel 34 Gas Block 35 Gas Block Pin 36 Handguard Holder 37 Bayonet Lug 38 Front Sight Base 39 Front Sight Post 40 Night Sight Spring 41 Front Sight Pin 42 Front Sight Spring 01 Muzzle Cap 02 Flash Hider 03 Flash Hider Retainer 04 Bipod Mounting Screw 05 Bipod Mounting Nut 06 Stock Trunnion Roll Pin 07 Handguard Holder 08 Carry Handle Pin 09 Carry Handle 10 Handguard 11 Handguard Spring (2) 12 Magazine Catch 13 Trigger 14 Disconnecter 15 Disconnecter Spring 16 Hammer 17 Hammer Spring 18 Sear Spring 19 Hammer Axis Pin 20 Trigger Axis Pin 21 Pistol Grip test fired.

There were no failures of any kind during the testing. In typical AK fashion, the empty cartridge cases were ejected forcefully to the right side and forward, halfway to the neighboring county. In doing research for magazine fitment in the ATI Galeo Galil clone, I came across threads on a few online firearm forums mentioning functionality failures of Galeo rifles with surplus steel Galil magazines.

In reading the forum threads, ATI Galeo owners determined that early production rifles had receivers that were approximately 0.115-0.120" thick in the area where the rear tab on the magazine would contact the receiver.

Owners of later-production 43 Front Sight Set Screw 44 Gas Cylinder Assembly 45 Front Night Sight 46 Guide Rod 47 Recoil Spring 48 Guide Rod Ring 49 Recoil Spring Housing 50 Gas Piston 51 Gas Piston

Retaining Pin 52 Bolt Carrier 53 Bolt 54 Extractor 55 Extractor Retaining Pin 56 Extractor Spring 57 Firing Pin 58 Firing Pin Retaining Pin 59 Firing Pin Buffer 60 Rear Sight 61 Rear Sight Spring 62 Rear Sight Ball Galeo rifles reported the receiver had been milled thinner, to approximately 0.100" thick in the area just to the rear of the magazine well.

The thinner receiver was credited by forum participants with allowing the rear tab of the magazine to be positioned 1/16" higher, thus raising the rear of the magazine up an equal amount in the magazine well and allowing for more positive stripping of cartridges by the bolt as the rifle is fired.

Some owners of Galeo rifles with the thicker receiver ground the receiver thinner in the area where the rear tab on the magazine contacts the underside of the receiver behind the magazine well, and reported improvement in functionality with ATI Galeo (Galil ARM) (Specifications subject to change without notice) 63 Rear Sight Pivot Screw 64 Rear Night Sight Spring 65 Rear Sight Plunger 66 Rear Night Sight Pin 67 Rear Night Sight 68 Receiver Cover/ Rear Sight Base 69 Rear Trunnion 70 Stock Pivot Spring 71 Stock Pivot Screw 72 Stock Pivot Screw Nut 73 Folding Buttstock 74 Magazine Follower 75 Magazine Floorplate 76 Magazine Spring 77 Magazine Body 78 Bipod Mount 79 Bipod Assembly 80 Butt Plate 81 Butt Plate Screw (2) surplus steel magazines.

I mention this as a point of interest. The receiver in the customer's Galeo was about 0.099" thick, and neither the customer nor I had problems with feed or functionality of the modified steel surplus Galil magazines in his rifle once they fit properly and locked

in place. The steel Galil magazines were complete functional equivalents to the Tapco magazine.

While the Galeo was in my shop, the customer had obtained several more Tapco magazines and upon return of his rifle, those Tapco mags proved to function 100% as well. Out of curiosity and in an interest to "conduct the other half of the experiment" I had two Orlite polymer Galil magazines on hand in the "odds and ends" box to be sold eventually. Both of them would not rotate back and seat into place in the Galeo.

Upon inspection, the front tab of the Orlites was taller than the highest front tab on the steel Galil mags prior to grinding. I did not modify the Orlite magazines because the customer was not interested in them, but the reader should take note that the same high front tab issue appears to affect Orlite polymer Galil magazines.

In summary, I am not claiming that all ATI Galeo Galil clones exhibit this problem with the front tab of surplus steel magazines not fitting between the receiver and the underside of the feed ramp. The Galeo is assembled using a newly-made milled receiver of reference dimensions of unknown origin. The receiver could be an exact dimensional match to an IMI receiver using IMI dimensioned drawings. Or perhaps it was patterned from a IMI or other Galil receiver.

The Galeo receiver is fitted with anew US manufacture barrel, and the bulk of the remainder of the parts are from demilled Galil AR, SAR, ARM, and possibly some South African R4 parts kits. The variation in any ATI Galeo could likely be a function of variation in the demilled parts from which a given rifle is assembled. AG

MAINTENANCE & REPAIR

Shotgun Headspace Regulation

Bringing the shotgun headspace to standard dimensions can reduce persisting misfires.

BY SERGEY LYALKO JANUARY 2021

ORIGINAL PP. 8-10

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Gunsmiths normally deal with headspace in rifles rather than shotguns. This is understandable since the shotgun is not so critical to accuracy and has lower chamber pressures. Normally, shotgun headspace is completely disregarded when diagnosing a misfiring gun. Three things a gunsmith needs to identify in a failing shotgun are insufficient firing pin strike, bad shotshells, and if there is excessive distance between the primer and the breechface of the gun.

For this article we'll assume the shotgun has a firing pin with normal length (1.5-1.8mm) that strikes hard enough and that the ammunition is within specifications. That leaves us with excessive distance between primer and breechface, which is an excessive headspace. The sketch here shows the rim recess and relation between rear edge of the chamber and the face of the action.

In the United States, chamber rim recess dimensions are specified by SAAMI as the American National Firearms Act (ANFA) standard. His is the depth of the rim recess, measured from line A to the edge of the chamber. S is the possible "off face" distance, increasing headspace, later assumed $S=0$. The

angle of 55 degrees is a standard tapering of the front portion of the rim recess. This number is indicated on all reaming tools. Standard SAAMI Z299.2-2015 (R-2019).

This standard defines the headspace as distance H from the central line A to the rear end of the chamber. For the 12 gauge this distance H has to be between 0.0624 (1.585) minimum and 0.0764 (1.941) maximum. The standard also assumes that the distance S between the chamber edge and face is 0, non existent. If this distance $S > 0$, then the actual headspace is $H+S$ and can be too long for igniting the primer, even with a sufficient firing pin. In these cases we are saying that the gun is "off face".

Putting the gun back to face (when $S=0$) is a repair procedure, which is beyond our scope here. For this article, if the gun is off face it must be rectified prior to any other modifications of headspace. It has to be put back to face so that $S=0$. Headspace is totally defined by rim recess and distance H. At different times and different countries the specifications for the chambers

SHOTGUN HEADSPACE REGULATION CONTINUED

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1&2, 20 and 12 gauge. 3, a high quality German reamer creating minimal chattering. 4&5, 20 and 12 gauge rings. 6&7, GO and NO-GO gauges. were quite different and not always consistent with current standards of shotshells. Some older European guns may have smaller depth of recess H, making the gun difficult to close as shell heads are sticking out. More often, the gun has an H dimension greater than specifications and the shell head is too deep below the chamber edge.

We are leaving aside the reasons why it is so—different specs, manufacturing problems, previous modifications, or wear. Instead, we look into the way of correcting this problem. We need to reduce the depth H of the rim re-

cess. Normally, it is done by soldering a ring into the chamber and then reaming it to specs of the rim recess. The required tools and rings are shown here.

The first step is clearing space for the ring in the chamber with one of the rim recess cutting tools (reamer 1 or 2) after removing the ejectors. The reaming chamber for the ring can be done manually or on lathe; I prefer the latter. The rings are about 0.6" wide and can be obtained at Brownells, however, I often Top Center The depth of the recess for the ring ideally is so that a fully inserted ring is just a bit below the chamber edge. This drop below should be quite less than the headspace.

The ring itself and the chamber recess should be thoroughly degreased before soldering. I cover both ring and the chamber recess with solder flux paste. I leave excess of the solder all around since all empties between recess and the ring have to be filled up. Remove the solder drips and start heating up the chamber. As always, keep the flame away from the solder itbefore soldering. Alternatively, any other reliable way of soldering can be used. There is no special concerns about the strength of this joint.

I use excess solder all around since all empties between the recess and the ring have to be filled up.

SHOTGUN HEADSPACE REGULATION CONTINUED

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Far This excess can be removed before heating. The can be started on a lathe but the last depth adjustments need to be done manually. self and heat the heavy chamber around the ring. When solder melts make sure that the ring is completely seated all the way by lightly tapping it down. The last step is done with a standard chamber reamer. It cleans the surface of the chamber, smoothing the ring step and also provides a standard rim recess.

You can start in a lathe, but the last cuts of headspace adjustment have to be done manually. During these adjustments we need to use GO gauge and finish the reaming when this gauge is flush with the chamber edge. This way we can be sure that the standard headspace is achieved. The alternative way of

adjusting headspace is to use the GO gauge in the assembled gun and stop reaming when the gauge just lets the gun completely lock the barrels.

After that is done, ensure the NO- GO gauge is sticking out beyond the chamber edge and that it does not Below far It is sticking out beyond the chamber edge, which is well visible. Above far allow the gun to completely close and lock the barrels. Remove the part of the ring in the ejector recess and install the ejectors in place. Normally, no actions require modifying ejectors or extractors after the rim-recess adjustments.

Finally, you'll be able to see how a standard shotshell will sit in the chamber after adjustment comparatively to pre-adjustment.

Conclusion Regulation of the shotgun headspace may be needed for some older foreign guns, guns with non-standard chambers, guns with previous modifications, or those that are worn out or misused. This procedure involves special reamers and rings, which can be obtained at Brownells or made.

It is not difficult but requires correct diagnostic of the misfires, which is a major reason for concern about headspace. If regulation is required, it boils down to changing the geometry of the rim recess with the tools shown here. Some accuracy is required, especially on the final steps of reaming the rim recess. AG

FINISHING

Bluing Browning Shotguns

Prepping and cold bluing a neglected Browning shotgun.

BY NORMAN E. JOHNSON JANUARY 2021

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There are times when refinishing and bluing an entire gun is neither practical nor necessary. Partial refinishing may be a viable option and can be performed with a minimum of tools and materials, saving both time and cost. A hunter came to my shop with a really sound looking 12 gauge Browning Pump Shotgun (BPS) that had some nasty, localized rust formations. The rust had caused mottled pitting along the entire left side of the receiver and a few other lesser involved areas.

It was found to be invasive enough to require quite extensive refinishing that I felt I could do by hand. I made up an adaptable tool that would hold select pieces of polishing paper with varying micron grades of abrasive. A short session of buffing indicated it would take lots of elbow grease, but I could see where it would get the job done well. From

my assortment of abrasive papers I used numbers 220, 400, and 600 U. S. mesh grade paper. The 400 and 600 grades are quite fine at 30 and 15 micron grade.

Browning polishes guns at a very high micron luster so I did Special angles and notches are formed allowing clips to hold various grits of pre-cut abrasive paper. A variety of pre-cut papers can be used. a final polish with 9 micron 1200 mesh. The metal prepping went very well. The special tool I made really got in there, aiding polishing.

I made sure not to buff into forbidden territory, which may tend to show a slight contrasting finish, but I pre-warned the customer there may not be a perfect match side-to-side on the receiver. That was perfectly acceptable in light of the condition the gun was in to begin with. Getting Down to Bluing A number of gun metals adapt to bluing quite different-

ly. I tested a couple spots with my oftused bluing solution be- Finding a gun like this can really sadden the owner. fore going to my final choice.

Trying spot finishes with different bluing solutions can be very revealing. If one doesn't work, simply buffing it off and trying another poses no big problem. For example, I tried an older version of Brownells Dicropan "IM" on a sampling of the receiver. This contains selenious acid, cupric sulfate, phosphoric acid, and nitric acid and is highly corrosive. This one has done a good job on most gun metals for me in the past, however, I abandoned it in favor of Oxpho- Blue Creme.

A test sampling on the shotgun metal showed a near match to the original finish. Most cold blue directions are quite basic, but there are a few keys

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that may prove helpful. Before applying any cold blue paste or solution be sure the surface to be blued is clean and dry. Oil or foreign material may repel the bluing chemicals. Lacquer thinner or alcohol will serve as a quick and easy cleaner. The temperature of both the metal and bluing solution also plays apart. Temperatures from 75-100 will enhance the bluing process. The warmer the steel, the quicker the bluing solution will react. Use apiece of clean cloth to apply the solution.

Wipe off with a clean, dry cloth almost immediately. Polishing with steel wool at this stage can help things along. Just wipe down to bare metal between applications. To obtain a darker finish with a more even bluing distribution, I apply repeated coats of bluing with a cloth barely dampened with bluing so-

lution with lots of rubbing and pressure. Never apply bluing solution with a dripping wet cloth or a blotchy looking effect could result. A clean, dry cloth follows each application.

If you've done things right you should see a really dark, high luster, A special polishing tool, a matching bluing solution, and lots of elbow grease did the trick. matching finish appearing. This is the time to apply a light coat of gun oil with little pressure on the cloth. Keep a light coat of oil on the newly blued surfaces thereafter, and advise the owner to do the same. New bluing can oxidize quite easily, especially if left bare.

Some gun owners have "poison hands", that is, an inordinate amount of perspiration and salt on their hands. These chaps often learn the hard way as their guns become rusty.

How and where one stores firearms is one of the keys to good gun care as well. I have had guns brought to me having been stashed away in a carry case after a hunt, with no further attention. I've seen guns like this actually rust to the inner surface of the carry case. We gunsmiths have dealt with many such carelessly treated guns.

Humidity between 60- 70% is about right in the gun storage area. Wood gunstocks may undergo changes where humidity gets lower than 40% or over 80% for prolonged periods. Of course, rust becomes a problem with unprotected metals and high humidity. The fewer guns brought in as a result of neglect, the better. But as one is entrusted to me, I treat it as a physician would a patient. The only problem is—a gun can't tell us just how it is faring. That is for us to determine. AG

TOOLS & FIXTURES

New Tools For Old Hunting Arms

There are many good reasons why hunters use non-modern hunting arms. Here are two examples from custom builds of a customer's crossbow and muzzleloader.

BY NORMAN E. JOHNSON JANUARY 2021

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If a job is even remotely related to hunting and shooting, the gunsmith often gets the nod. Here are tools I built for hunters using a crossbow and a muzzleloader. Crossbow Foot Stirrup In the modern day hunting and shooting world the crossbow has reached unbelievable popularity. Its power and performance far exceed the older crossbows, but along with this comes increased maintenance and the demand for methods of cocking them.

Where the older crossbows were cocked by simply pulling the string with a hand on each side of the frame, crank cocking aids are now

routinely required. Those bows of lesser power can be cocked with a rope cocking aid which reduces pull force by 50 percent, but this requires a good, sturdy foot stirrup as a counterpoise to the cocking action used. The adapters are made of cast aluminum. Here's how I built and installed a custom foot stirrup for cocking a hunting crossbow, which worked out perfectly.

The crossbow was turned over to me without a foot stirrup and one had to be modified and mounted while keeping the bow as short as possible. While cocking a crossbow, the stirrup is placed on the ground or other level

place as the foot is placed in a loop or stirrup to hold it down. With the bow held vertically, the shooter bends over it with the butt plate of the crossbow against the chest. If the bow is too long this becomes most difficult.

Unless a mechanical aid is prop- Far Both a set screw and J-B Weld are used to firmly fasten the ends of the stirrup to the side adapters. Rubber padding is slipped over the foot loop to prevent slippage and make it more quiet during use while hunting.

NEW TOOLS FOR OLD HUNTING ARMS CONTINUED

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This keeps the foot stirrup very compact and the bow shorter. erly used to reduce the pull force, older or less capable users are unable to draw and cock it. On the crossbow brought to me, a very low mounted stirrup was needed. Ordinary stirrup attachment utilizes a bolt at the end of the main crossbow beam to hold it in position. The problem with this type of attachment is it left the bow too long and difficult to cock. This was solved by using special side The bow is much closer to the ground while cocking.

The foot stirrup attached to the sides of the bow frame help keep the crossbow as low as possible to the ground. Here a special rope cocking aid is used to reduce bow cocking pull force by 50 percent. attachments to fasten the ends of the stirrup to the crossbow.

These special parts had to be made to fit this specific bow. Making the Parts As the pictures show, a pair of adapters were made to join the two ends of the stirrup into the concave channels along the sides of the crossbow beam.

The adapters were formed from cast aluminum 3/4 inches in diameter. Holes were drilled in the ends to admit the tips of the stirrup. J-B Weld, along with a pair of set screws, was used to permanently bond the parts together. A flat spot was then formed near the ends of each adapter for each 1/4-20 attachment bolt. Properly-positioned holes were drilled and tapped in the rail channels of the bow to hold the rounded adapters in place.

Positioning in this way mounted the stirrup with just enough room for a full-size hunting boot, making a crossbow that was easy to cock using a special rope cocking aid. Muzzleloader Capping Tool Among the many accessories used by the muzzleloader shooter is the capping and decapping tool. Though a common percussion cap can be installed with bare fingers and removed with thumb and forefinger or a pocket knife, it isn't easy, particularly with cold fingers or when a quick reload is required.

A nifty combination tool can solve the problem. There are capping/decapping tools on the market, but a very particular customer approached

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me with the possibility of making a better tool for the job. He had some upcoming deer hunting planned and asked if I could make a dual purpose tool that could be worn around his neck... a more compact and maneuverable tool than those he had seen. My sketch of such a tool was convincing and the “go ahead” was given. The finished tool is shown on the right. No special tools are needed in making this compact combination tool.

Making the Capping Tool The raw materials required for making the proposed muzzle-loader capper/decapper tool cost less than a dollar, consisting of a common 1/4- 20 round head fillister screw and apiece of 1/2 x 5/8 x 1 1/8" cast aluminum stock. Total construction took me a little over an hour. The illustrations will provide some latitude for personal touch. I used a hacksaw and file to form the main body and capping cup.

The cap retaining hole in the cup is drilled to just over the outer cap size with a proper number drill. The hole is drilled to a depth of an average percussion cap to fit flush with the brim of the cap. Then round off the capping cup

NEW TOOLS FOR OLD HUNTING ARMS CONTINUED

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This is an easy task with this combination tool. with a file, leaving an outer wall thickness of about 1/8". At this stage I tested the size by placing a percussion cap in the cup to try the fit. Next, the decapping fork is made and installed at the opposite end and side of the capping cup. Here a number 7 drill is used to make a hole at the end of the tool for the 1/4-20 screwhead. The thread is then tapped.

At this stage of development I placed the bolt in the lathe and cut off the rounded portion of the head, The simple combination tool makes the task easy. The lanyard makes it even more versatile. leaving about 1/8" rim thickness for forming the decapping fork. I then cut away from the bolt rim enough metal to form the two-tined fork to fit over the nipple. I made the saddle in the fork with a

small, round file to a half-circle depth and diameter a few thousandths wider than the tapered nipple.

The decapping bolt is cut to a length of about 3/4" and screwed into the tapped hole at the opposite side and opposite end of the nipple body. The fork is set at a 45 degree angle to the tool body for right- A hole was then drilled in the upper side of the tool body for the lanyard. I used blaze orange nylon cord with sufficient length for easy maneuvering as the percussion caps are installed and removed. The customer immediately tried the tool and said it was exactly what he was looking for.

I guess you can't beat two-way satisfaction! I don't know about the rest of you machinist/gunsmiths, but I totally enjoy the challenge in creating and making different things. My customers and others that know me are aware of my willingness to do so.

Today's gunsmith should be prepared to perform vastly different jobs in connection with equipment other than guns.

It will benefit the gunsmith to learn more about the principles of archery and muzzleloaders as it involves ballistics, maintenance, and repair of a different type—the crossbow in particular. In my own experience, crossbow owners began requesting my services 20 years ago, and few were turned away because I couldn't help them. Fact is, I have been an active archery hunter since 1983 hand use, as shown in the illustrations.

As a means of holding the thread tightly in the nipple body, I tapped the hole at less than a complete thread for a snug thread fit. and know first - hand the needs of the crossbow owner. I have similar interests in muzzleloaders as well. Diversity such as this will only increase the jobs you can take. AG

SAFETY & COMPLIANCE

Firing Pin Logic and Mechanics

An overview of a critical but overlooked part of every firearm.

BY ROBERT K. CAMPBELL JANUARY 2021

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If there is an overlooked part in any firearm, it is the firing pin. The firing pin is an important part of ignition and also has a bearing on accuracy and lock time, yet shooters seldom think of it unless it breaks or gives trouble. There are also safety concerns with certain types of firing pins if the shooter isn't schooled in floating firing pins. Recently I was entertained to a story about a customer who brought a rifle into a pawn shop.

Let's just say he isn't a common gun owner and is of the type we could probably do without. He brought in a padded case containing an AR-15 rifle to pawn or sell. The shopkeep asked if the gun was loaded and the fellow replied that he didn't think so. While wrestling the rifle from the case, he dropped the still-loaded magazine. My friend Gene took over, pulling the charging handle to the rear while keeping the muzzle pointed in a safe direction to clear the rifle — which ejected alive round!

We won't go into the problems with keeping a rifle chamber loaded in the home or the idiocy of bringing the piece into a shop loaded, but something else was curious. The cartridge extracted from the chamber

had a distinct firing pin indent. Gene wondered how that happened. To told him to count the rounds in the magazine, betting there were thirty. There were.

The only answer I have is the fellow had hand-fed a cartridge into the chamber and let the bolt slam, resulting in a firing pin mark on the primer from the floating firing pin. While we know not to load an AR or M1A in this manner, not everyone does. This fellow was lucky and his poor gun safety is an accident waiting to happen. I know the difference between different types of firing pins and how they work.

As I have dealt with firing pins I have developed a healthy respect for their function and the need to learn more about them. But I am still learning. A problem with firing pins doesn't become evident until we pull the trigger and nothing happens. We hear a click instead of a bang. This is pretty serious in a personal defense firearm and bad news in competition. Many shooters look to the ammunition first and don't search for a potential mechanical failure.

While this seems obvious to some it isn't always the ammunition. In my experience the cause of a failure to fire is just as often

a dirty chamber or a problem with the firing pin. There are many different types of firearms and firing mechanisms but they have some type of firing pin or striker. The firing pin strikes the primer and forces the outer shell of the primer against an anvil inside the primer which sparks, igniting the priming compound and then the powder.

This is pretty simple and it occurs in a millisecond but all of those moving spring-loaded parts have to be properly in specification and must strike the primer with enough force to crack it. The action is more involved than the cartridge and with more parts. The cartridge has to fire but once while the firing pin will be cycled thousands of times.

Transfer Bar Problems Transfer bar systems were introduced as early as the turn of the twentieth century in the old Iver Johnson and Hammer-the-Hammer transfer bar safety system. They are usually quite safe and reliable. When they were first incorporated into heavy revolvers such as the Charter Arms Undercover and Ruger Security Six some shooters felt that the system might not prove far

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as accurate as the conventional firing pin mounted in the hammer. Locktime, along with a clinging to tradition, was the concern. Considering the accuracy of the Ruger GP100 these fears are groundless, although mass production does sometimes present difficulty. There are occasional problems with the hammer contacting the transfer bar or frame too soon, resulting in a misfire or failure to fire. This isn't that difficult to diagnose.

It seems like every time this occurs the shooter mentions the rate of failure is very small, sometimes one in a hundred, and it sometimes gets passed off as bad ammunition or a high primer. This isn't a valid assumption if the problem reaches a 10% misfire rate. It is easy enough to cure this problem. Take about 0.020 off the hammer at the point the hammer strikes the frame.

This isn't necessary if the revolver is properly firing but is often the cure for an occasional failure to fire with a transfer bar type revolver. I have yet to see this problem on a

single action revolver, foreign or domestic, only double action revolvers. On the subject of double action revolvers, the firing pin design of the Colt Python and the earlier Colt Three Fifty Seven is such that the revolver should never be dry fired. By the time it arrives at the shop it is too late.

Without getting into a discussion into primers—and I handload CCI, Federal, and Winchester primers with good results—sometimes a firearm will fire fine with one make and not another. Some primers are thicker, which is needed with Magnum pressure. The bottom line—do you want a firearm that won't crack every primer? You do not know which primer the factory loads and most giant makers use several types. Occasionally, congealed oil and solvent in the firing pin channel may cause a problem.

This mixture looks like varnish in some firearms. A lack of cleaning and maintenance and perhaps a dirty powder or even lead residue makes this mixture. A simple clean-

ing is often sufficient to get rid of the failure to ignite the primer. I have actually observed broken firing pins that still ignited firearms, something that is more likely with two piece firing pins; I have seen several and heard of a few more. This isn't a good thing and eccentric wear often is the result. Keeping things clean helps.

There are other causes of light primer strikes, primarily related to self loading handguns. I probably see ten self loaders for every revolver these days, so I see more issues with these firearms. There are also ARs and bolt action rifles as well. In older military rifles there is a possibility that very excess headspace will cause problems, though more often a blunted, damaged, or off-spec firing pin is a problem. The firing pin may be below the minimum measurement for firing pin protrusion.

Hard primers area possibility but unlikely with While it is difficult to observe and gauge, springs become worn.

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The bolt assembly houses the firing pin and problems related to ignition are often contained in the bolt. If it hangs up, locktime is slowed. American-made ammunition. A number of years ago a local agency purchased several thousand rounds of cheap Egyptian surplus 9mm Luger, which proved to be a very bad move by an inexperienced instructor (there are many personnel in instructor roles whose total experience is limited to a school lasting a few weeks).

In their SIG pistols this ammo had a 50% failure rate and 25% in their Beretta 92s. Even worse, by the time I was asked to examine the pistols they were rusting from the corrosive priming compounds. A weak or completely broken firing pin can be a problem or even improper assembly, but very occasionally it is actually the ammunition. The floating firing pin I mentioned with the AR-15 pawn shop incident should be understood. The M1 Garand and M14/M1A have floating firing pins.

The design works well and is far safe when the rifles are used properly. The magazine or en bloc clip is locked in place and the bolt ran forward. This slows the bolt down due to loading the cartridge from the magazine or en bloc clip. If the cartridge is single loaded loose and the bolt dropped forward on it, the floating

firing pin will run forward harder and make an indent in the primer. I have never actually seen a rifle fire in this manner but I am certain it has happened.

This is why competitors use harder CCI rifle primers. Even when firing a few rounds at targets and during evaluations these rifles should always be loaded from the magazine. If you inspect a rifle cartridge that has been chambered and then extracted without firing it is normal to see a slight dimple from the floating firing pin, although this varies with different makes and types of rifles. It is of no concern.

A dimple from dropping a loose round in the chamber and then dropping the bolt will be deeper from lessened resistance and friction, and by extension can be more dangerous. There are many types of firing pins. Some are so thin that it appears as if they would be easily broken but are hard tempered and durable. They are not always perfectly straight and some have noticeable angles. With this understood it is easy to see why the firing pin and inconsistent movement may cause a problems with accuracy.

Congeaed powder and ash in the firing pin channel may result in inconsistent ignition. The cartridge may be pushed a bit into the chamber with one strike and barely struck with another. This

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Neither presents much of a difficulty for a properly in-specification firing pin and action. has been heavily greased and in longterm storage we clean the firing pin channel as well as possible. If the firing pin channel is gunked up and the firing pin has to fight to get through, cannot be good for accuracy, especially in rifles. We know that if the revolver hammer contacts the frame as it falls, accuracy or ignition will be a problem. Correcting hammer side play solves this problem neatly.

I've experienced another problem from the direct result of inconsistent firing pin energy. A Smith & Wesson Model 5906 9mm had began to group badly for an in service officer, so badly he nearly failed to qualify at 25 yards. There seemed to be no apparent problem until I did a detail strip and found brass shavings in the firing pin channel. Could this be the problem? After the channel was properly cleaned and the firing pin replaced the pistol returned to its original accuracy potential.

I am certain the same could occur with a badly weakened firing pin spring. This is the reason that when we clean a military rifle or any firearm that The new design

Python should not have the same problem in dry fire but only time will tell. ignition simply can not be consistent. A firearm with mediocre to fair accuracy may see some improvement with this simple cleaning; it will certainly be more reliable.

Summary In my experience, even weak firing pin springs and inconsistent actions will set off primers but a good, sharp firing pin and a properly set up, clean action will be the most efficient and demonstrate best accuracy. Spring rates matter. I have even considered cocking piece drag, which exists but is seldom a concern save for those in the higher strata of shooters. In general, the better the firing pin is supported during its entire travel the less trouble you will have.

There is nothing you can do to change the design other than to be aware of it but you may be able to polish the breech face and keep the firing pin channel clean and eliminate most problems. AG

MAINTENANCE & REPAIR

Multitasker Series 3

A great multi-use tool for gunsmiths and armorers.

BY STEPHANIE A. MARTZ JANUARY 2021

ORIGINAL PP. 21-22

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Every gunsmith or armorer has their go-to multi-tool that they use when they're out of the shop. The Multitasker Series 3 is that tool for many. It is strong, durable, and made for weapons maintenance and equipment installations. Multitasker Tools is a company that is built around the shooter's needs. As gunsmiths and armorers the end goal is to allow the operator to perform with their equipment functioning to the best of its ability. Multitasker tools does just that with their Series 3 and Twist.

The Series 3 is a multitool ideal for use when away from the shop but still able to perform any duties needed to keep a weapon going. The Twist is more minimalist than the Series3 but still is able to perform multiple jobs. Shane Keng, the president of Multitasker Tools, also invented the Mag- Pod, an attachment that improves monopod use in magazine-supported shooting positions while not taking up any rail space as a bipod would. Knowing who is inventing the gear that we use and trust should be important to anyone.

Having a mindset and goals that are inline with the end user is huge. This company does just that. The tools are made for the shooter and the maintainer with no added gimmicks. Applications The Multitasker Series 3 serves a wide range of purposes. It is geared more towards the AR- Far This was used during rifle cleaning and maintenance.

The tool is compatible with the Otis Technology cleaning kit due to a 3/32" pin punch with 8-32 male thread that attaches to the Memory-Flex cable within the kit. 15 platform however has shown that it works for optics, weapon mounted lights, and other fixes even on machine gun platforms. They feature CNC machined pliers (D2 tool steel, not investment cast) and non-slip G10 scales (black or tan), and a removable pocket clip.

Tools include a 3/8" hex for La Rue mounts, 1/2" hex for scope rings, dual lug M4 castle nut spanner wrench and screwdriver, 3/32" pin punch with 8-32 male thread for Otis Technology cleaning kits, a radiused tip carbon scraper, and 3" D2 tool steel knife blade (plain edge or

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partially serrated). The 1/4" magnetic bit driver features a M16A2 front sight adjuster and fits the included hex bits: No.1 Phillips, 3/32 slotted, 3/16 hex, 9/64 hex, 1/8 hex, 7/64 hex, T10 Torx, and T15 Torx. The shape of the handle is not straight like other multitools as it is meant to mimic a tactical folder, shaped to the user's hands with a rounded grip. The non-slip G10 scales improves grip and does not get as hot as bare metal would in the sun.

Bronze washers are used within the tool instead of cheaper stainless steel washers, allowing for smooth movements without deforming overtime and without needing lubrication. The knife features an actual folder liner lock instead of a standard multitool lockout which allows a lot of blade play. Strong tools are needed when doing repairs or remedying malfunctions. Pliers with strength is a very important tool for maintainers. Often times things need to be pulled and cranked on.

When all we have is a multitool out in the field we need those pliers to hold up. The Series 3 features pliers that are CNC'd from D2 Steel. Just as we know the strength of forges and billets, these pliers have that same durability. Within the pliers is a replaceable wire cutter if worn and needed replacement. The pocket clip allows the user to store the tool on their belt and mine has not shown any bending or wear through two years of use. It is also removable if you'd like to store it in a pouch instead.

The knife has proven to be sharp and strong. It locks into place and has not shown issues with staying locked. The castle nut wrench and screwdriver has not shown bending when used as the wrench and the tip of the screwdriver has upheld when used on tough screws. Feedback from Users This tool has been my go to for range support and quick fixes when I'm not in the

shop. It has shined largely on the rifle ranges due to the front sight adjustment tool and the strong pliers.

Many malfunctions occur due to both operator and weapon induced issues and a quick tool available to clear a stuck casing or a seized up sight is ideal. I've also seen this tool used to install handgun optics and weaponmounted lights with included Allen bit set. I've used the push punch on the tool many times to strip lowers on M4s and M249 trigger housings for sear replacement. Overall, I've used and seen others use this tool on more weapon types than a standard multitool could ever support.

It is simple enough to be used by operators yet strong enough to be used by maintainers. All product questions can be answered on Multitasker's website, MultitaskerTools.com/product/multitasker-series-3.

The list of dealers that sell Multitasker Tools is immense, to include Brownells, Midway USA and many others. AG

READER FORUM

Reader Forum

BY AMERICAN GUNSMITH EDITORS JANUARY 2021

ORIGINAL PP. 23-24

Gunsmith Search I am a lifetime American Gunsmith subscriber and a fan of the Reader Forum. I have a problem obtaining local service for a gunsmithing job and would appreciate if anyone that has a suggestion for service email me. I have a Falling Block action that is barrel up and chambered in 22 Hornet and am in need of having the extractor fitted. If anyone can recommend a gunsmith performing single shot rifle action work, preferably in the Northeast, please contact me.

Thomas Muscolino NEF Handi-Rifle Rueben Cole (contact information omitted in this digital edition) wrote in the October 2020 Reader Forum concerning problems with a New England Firearms Handi-Rifle SB2 opening up when fired. This problem happens when the lock block in the receiver is not fully engaged with the barrel lock. Spring pressure on the lock block is not fully moving the lock block into place with the barrel. This can happen on any break open single shot, not just NEF guns.

Polish up the engaging surfaces on the lock and barrel locks. Also address any burrs, rough edges on the side of the lock block. A radius on the side edges is all that is normally needed. The receiver can be very rough, rubbing on the clearance between the lock block and receiver frame. If the lock block hangs up for any reason it will not fully engage the barrel lock. I have found that lockbox springs can go bad, but this is rare.

The hinge pin fit to the barrel is a factor on headspace, especially on a worn-out gun, as repair of the hinge pin can move the barrel back more than normal. The hinge pin and barrel should be lubricated with a good grease, not oil. How the rifle is held

when firing shouldn't have an effect, something that can be an issue with some break open shotguns like the Winchester Model 370. Regardless, spring pressure on the lock block is what engages it into the barrel. I'd guess Mr.

Cole's 22-250 barrel is not letting the lock block fully engage the barrel upon closing. If smoothing the parts doesn't solve this, check for high spots on the engaging surfaces. Check the barrel lock surfaces first. The angles on the engaging surfaces may not be as precise as needed. Non-drying Prussian Blue (Permatex.com, from an auto parts store or similar marking solution will help. Place a light, even coat on the parts, then open/close several times to reveal the high spots.

Remove a tiny amount of metal (0.001-0.002) from the high spots carefully with a Dremel disk cut off wheel. Go slow and be careful! Repeat until the high spots are gone. It is likely that the 243 barrel is working fine. Note, it's still possible to get a misfire if you pull the trigger and let up just as the sear is about to release. The safety transfer bar can drop down before the hammer hits it but this is rare. Wolsey SD 57384 AR-15 Bolt Carrier Tilt Do you really know how ARs actually function?

The bolt carrier group doesn't tilt as it cycles because it's not being pushed rearward/tilted up by the gas tube/gas key interface. Gas goes into the expansion chamber of the BCG where it expands and pushes the body of the BCG straight back because the bolt is still locked in battery in the barrel extension. When unlocking occurs, the cam pin rotates the bolt within the BCG. The carrier pulls the bolt the rest of the way out of the extension and takes the bolt with it as it cycles.

As for loose fits between uppers/ lowers and barrels/receivers, I suggest finding better parts, a good barrel nut socket, and torque wrench. If you've got play at the barrel/upper interface, you've got big problems. A loose fit between upper and lower impacts accuracy/precision when the upper is the entire rifle and carries the sights/scope, BCG, and barrel. No play between the upper and lower is going to throw off any parts of the upper assembly.

As for high-end ARs and their accuracy guarantees from manufacturers like Les Baer, if you're willing to pay \$2500-\$3500 for that 1/2 MOA guarantee and think it's being achieved with special parts rather than simply taking advantage of the inherent accuracy of the AR architecture, knock yourself out. I own a Les Baer Premier II Tactical 1911 with the 1.5-inch-at-50-yards guarantee and that pistol will do what it's supposed to do with even cheap cast 200 grain SWCs.

I've also got two AR-15s with 18" Wilson Combat Stainless Match barrels (5.56x45mm and 7.62x40mm Wilson Tactical) both sub-MOA with nothing but cheap uppers and lowers shooting throw together reloads using Hornady V-Max bullets. Chrome-lined, hammer-forged barrels in military ARs has a negative effect on accuracy and precision, though they have long barrel life. Pinned front sights, nonfloating handguards, pencil barrel profiles also don't help. Daniel P. Horn D. E. Meyer Author Joe Carlos responds.

You obviously spend time researching the Stoner Platform. Book learnin' is a good thing but if one really wants to understand the rifle at some point you have to get out from in front of the computer and either employ the

READER FORUM CONTINUED

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thing in real combat on the battlefield, shoot it in competition, or perform tests with it. I have done all three with many sample rifles and will describe the testing performed prior to writing "Combating AR-15 Bolt Carrier Tilt." It is not the unlocking of the bolt that is a concern with bolt carrier tilt, it is what occurs just prior to firing the round when the carrier is at rest. The back of the carrier is down, sometimes even to the point of resting on the bottom of the receiver.

That causes the bolt face to be at an angle and the round in the chamber to also be at an angle to the bore. Readers just joining the conversation can see this bolt carrier tilt by opening their gun safes and taking out and inspecting a couple of uppers. Contemporaries of Stoner recognized this carrier tilt was a design flaw with respect to shooting tight groups. Old time gunsmiths of the era silver soldered shim stock in long strips on either side of the bottom of the carrier.

Eventually, some of these pads came loose and jammed up the guns and that idea was dropped. Gunsmiths collectively stuck their heads in the sand for decades and pretended that the problem didn't exist. When I started to experiment with solutions years ago I had already learned from those gunsmiths to avoid the silver solder approach and installed cap head screws. Because of their domed heads only the top of the curved head makes any contact with the inside walls of the receiver keeping friction to a minimum.

There is not much pressure on the dome heads so you only need a little contact surface. As soon as I started shooting groups with the pads in place I saw groups tighten up. So every gun that came in my shop for nearly a year got tested with a true match carrier of the same manufacturer without pads and with. I made dozens of test firings with the same lots of match ammo but no other changes.

At the end of the study I ran an average of the group sizes and found that those with the pads were 14% tighter than those without. I don't know if you have ever shot in competition but I have done so extensively. When I was on the circuit I would have killed for a 14% reduction in group size at so little cost and with no downfalls. Lots of competition shooters are using my carriers with the anti-tilt pads and I have an inbox full of thank you notes but no accuracy complaints to date.

As I was closing that article I mentioned that my efforts should be only considered as steps and encouraged other gunsmiths to come up with their own designs and ideas to improve on my work. Perhaps you will end up being the person to invent a better mouse trap. If so, I will be the first to congratulate you. A word of advice, however: I suggest you perform your due diligence by doing a lot of testing on the range with scores of rifles before settling your opinion.

Barrel Rechambering I have a short-chambered (unused) barrel chambered in 6.5 Creedmoor for a Mauser 98 I would like to rechamber to another 6.5mm/.264 caliber. What other cartridges could I go with? The reason I want to change the chambering is due to differences with Mauser 98 and 96 action, the standard internal magazine, and a change in bottom metal along with a desired conversion to a detachable magazine. I'm considering 6.5 PRC. James Parr From Paul Mazan.

This will depend on what you're trying to accomplish. 6.5 Creedmoor is among the best of the 6.5s so you'd have to decide what is gained by rechambering. It would take having a set of SAAMI drawings to compare other 6.5mm cartridges and pick those that are larger, longer, and still use the same base diameter. Also, check the cartridge specifications in a current reloading manual. Pay particular attention to the case diameter at the shoulder (0.462") and from base of case to shoulder (1.490").

About the first one you'll see in Hornady 10th Edition Handbook of Cartridge Reloading is the 6.5mm-284 with the same case head diameter of 0.473. You might search through a list of wildcats for something else but this may become quite involved. I can visualize lots of shooters and hunters who would really cherish your barrel already short-chambered 6.5 Creedmoor. AG

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