Rifling Buttons

Information Sheet

Introduction to Button Rifling

The button rifling process is one of the most widely used methods of producing rifled barrels in industry, and also one of the easiest to adapt for use by the hobbyist gun-maker. In this process, a smooth-bore barrel is first produced with a bore diameter slightly smaller than the bullets it will eventually fire. Then a special tool called a "button" having a series of lands and grooves on it in a mirror image of the desired rifling pattern is forced through this smooth-bore barrel. The button does not cut into the barrel, but rather causes the steel to flow under pressure, cold-working the rifling into the bore. Since all that is needed to produce the rifling is a button of appropriate size and a means of driving it through the barrel, this is a very time-efficient process. As an added benefit, the cold-working work-hardens the steel, particularly at the edges of the grooves where the deformation is greatest, which enhances the wear-resistance of the barrel.

Product Description

Most industrial rifling buttons are made of tungsten carbide, due to its superior hardness, wear resistance, and lower coefficient of friction. However, carbide buttons are not readily available to the general public and can be difficult to produce without specialized (and very expensive) machinery. Thus, to provide amateur gun makers and hobbyists with better access to rifling buttons, Atomic Rifling and Creative Operations LLC manufactures rifling buttons out of tool steel. Tool steel rifling buttons can be made much more cheaply than carbide ones, and since the average hobbyist is not mass-producing barrels by the thousand, wear resistance of the button is not as critical as it is in industry.

Early on, many different styles of experimental tool steel rifling buttons were produced and tested to determine the best design. Some of these prototypes (including both buttons that were actually used in testing and unused buttons from the small production runs that produced the buttons for testing) are available for sale, but based on the results of the testing performed, Atomic Rifling and Creative Operations LLC now produces only two standard styles of rifling buttons. In both cases, a rod of A2 or D2 tool steel is first turned to the desired diameter. Typically the desired diameter will either be equal to the diameter of the bullet or just a few thousandths of an inch larger. Next, a very slight taper is machined into each button over about two thirds of its length. This allows the small end of the button to fit into the bore in which the button will be used, such that the walls of the bore will contact the button at a very slight angle, which in turn reduces the chances of the button sticking or galling. Then the inverse rifling pattern is machined into the button, and here the two styles diverge.

For a standard 6-groove rifling button, a set of 6 spiral flutes are machined into each button, with enough depth to afford clearance at the bottom of the groove. When driven through a barrel, this will produce a simple 6-groove rifling pattern with relatively wide lands and narrow grooves. This is by design, both because wider lands afford more material to wear over time, theoretically increasing the useful life of the barrel, and—perhaps more importantly—because narrow grooves displace less material, making the button easier to drive through the barrel.

For a "triangular" rifling button, three spiral flats are machined on the button, leaving just enough of the original perimeter intact to form three ridges that will produce three narrow grooves in the bore when the button is driven through the barrel. Because most barrels require more than three sets of lands and grooves, triangular rifling buttons are typically driven through the barrel multiple times to produce a barrel with some multiple of three sets of lands and grooves. That is to say, if the button was driven through the barrel twice, indexing it 60 degrees between passes, a 6-groove rifling pattern would be produced. With 3 or 4 passes, a 9-groove or 12-groove pattern could be produced. Because a triangular button makes only a minimal number of grooves on each pass, it requires slightly less force to drive through the barrel than a standard 6-groove button does, but this advantage must be weighed against the necessity of driving it through the barrel multiple times.

After the machining is complete, the buttons are hardened by heat treatment to provide the necessary hardness and wear resistance. The heat treatment process leaves a black oxide finish on the buttons which provides some measure of corrosion resistance. However, new buttons are usually coated with paraffin to provide added protection against corrosion during storage and shipment.

Guide to the Use of Tool Steel Rifling Buttons

Tool steel rifling buttons can be used to produce high-quality rifled barrels, but producing smooth, high-quality barrels by this method is both an art and a science. The following step-by-step guide is provided as an aide to help the first-time barrel maker obtain satisfactory results:

1- Prepare the button for use. To minimize the potential for sticking, the surfaces of the button that contact the bore should be mirror-smooth. New buttons usually come coated in paraffin and with a black-oxide finish to resist corrosion prior to use. It is advisable to scrape off most of the paraffin prior to first use so that the surface finish can be inspected. The black oxide need not be removed as long as the surface is smooth, but new buttons should generally be polished prior to first use using 600-grit sand paper or emery cloth. If the button has been used before check the surface for rough spots, such as rust or built-up metal from sticking of the button in previous rifling operations. Any rough spots should be polished off. If large quantities of built-up metal are present, they can be removed using a fine-cut hand file, after which the button should be re-polished (the button will have about the same hardness as the hand file, so the file generally will not cut any appreciable amount of material away from the button, but it may still mar the surface finish).

2- If not already done, drill out the bore, ream it to the correct diameter, and lap as necessary to provide a smooth surface finish. The diameter of the bore is of critical importance. If the bore is too large, the button may pass through the barrel without leaving any rifling grooves, or may leave grooves that are too superficial to impart spin to the bullet. If the bore is too small, it will be excessively difficult to drive the button through the barrel, and the button will be more prone to stick, resulting in very rough rifling. Typically, the bore diameter should be about 0.005 to 0.009 inches smaller than the diameter of the button, but the optimal diameter may vary depending on the material from which the barrel is made, the surface finish of the bore, the type of lubrication used, the intended use of the barrel, and other factors.

3- Blue or anodize the bore. A bare metal bore is much more prone to cold-weld to the button than one with a thin oxide film. Thus, the bore should be flame-blued, anodized, or otherwise blued prior to rifling. Oxide films produced by anodization tend to be porous, and thus in theory they retain lubrication better, reducing friction and further preventing the button from sticking. In testing at Atomic Rifling & Creative Operations, flame blued bores were rifled successfully. Test results for chemically blued and anodized bores are not yet available.

4- Lubricate the button and the bore. A well-lubricated bore is essential to producing smooth rifling with tool steel buttons. Various lubricants can be used. One lubrication method consists of filling the entire bore with moly grease. This method has been used successfully but is rather messy, and any metal filings or other particles of dirt that get into the grease as it is being packed into the bore may compromise the lubrication and cause the button to stick. In testing, sulfurized canola oil was shown to be superior to moly grease, at least at low temperatures. Industrial swaging and drawing lubricants are also worth considering.

5- If at all possible, test the button on a short section of barrel before attempting to rifle the intended barrel. Usually, if anything is wrong with the combination of button diameter, bore diameter, surface finish, surface coating, and lubrication, the button will begin to stick within the first few inches, so if a 3-inch test piece can be rifled successfully, then usually the same combination will work on a barrel of any length.

6- Drive the button through the barrel. The simplest method of driving the button through the barrel is to pound it through using a hammer and a piece of steel rod small enough to slide easily inside the bore. If available, a hydraulic or mechanical press may provide smoother motion of the button (and hence smoother rifling) with a great deal less work.

7- Good luck, and happy gunsmithing!