
Gun Stocks

STOCK DESIGN AND STOCK STYLE

Types of Gun Stocks

A gunsmith requires a basic understanding of stock function prior to becoming a stock maker. A rifle stock, in function, is nothing more than a segment of wood, fiberglass, plastic, or other material shaped to support the rifle's barrel and action. It also functions to conform to the shooter's body so the shooter can control the firearm. That's the mechanical side of it. However, arms lovers the world over consider a stock much more than a mechanical device. They think of a gun stock as a work of art and function (Figure 1). As a prospective gunsmith, we hope this is your position.



FIGURE 1—Notice the attractive oak-leaf pattern on this Bishop-III stock. (Photo courtesy of Reinhart Fajen, Inc.)

Stocks can be built in a multitude of styles with a stock shape to fit everyone. Even factory rifles come in a wide variety of stock styles. Factory stocks, incidentally, have come a long way and can be considered quite good today, although certainly not in the realm of a custom-made stock. Figure 2 shows a gun stock labeled with its proper nomenclature.

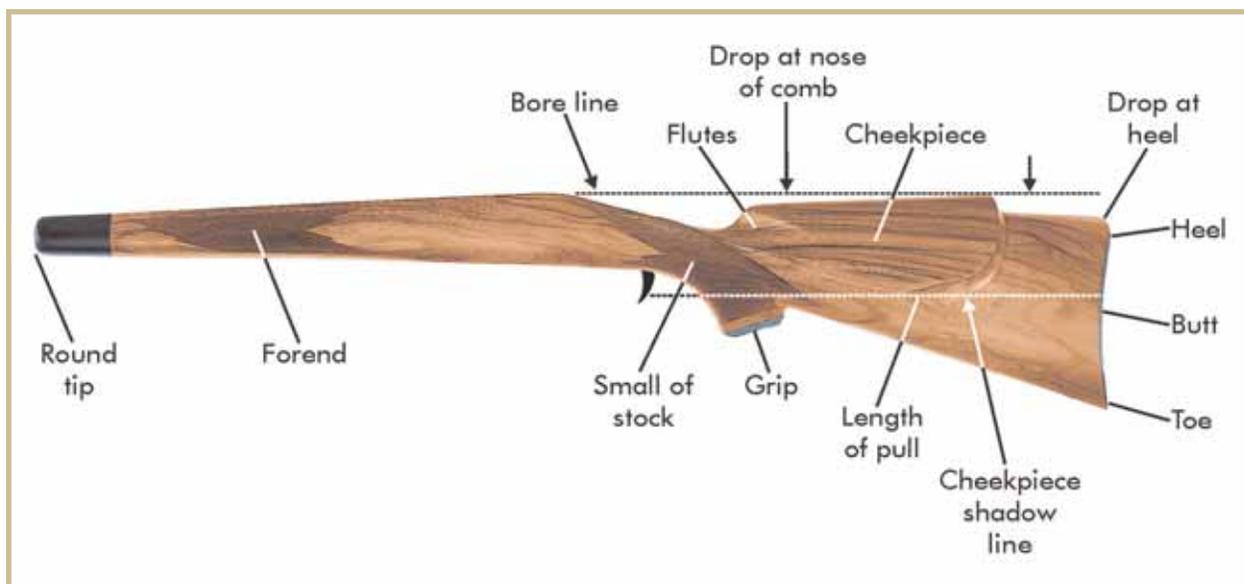


FIGURE 2—Become familiar with the names of the parts of a gun stock.

Early Stock Design

Turning the pages of gun history to an earlier time reveals that the first stocks well known to American shooters had a great deal to do with contemporary stock designs. However, such *muzzleloader stocks* left a lot to be desired. For shooting offhand with limited recoil, such as when firing the average .45 caliber Pennsylvania muzzleloader, the stock of old was workable. However, these stocks have too much drop and too narrow a comb combined with a thin metal buttplate.

Drop is the distance downward from the line of sight to the upper edge of the buttstock, called the *heel*. *Comb* is the upper edge of the buttstock. Drop and comb features made the old-time stock uncomfortable to shoot when the rifle had heavy recoil. Therefore, early stock designs aren't appropriate for today's high-powered rifles.

Modifications in stock design came slowly over many years. You, as a gunsmith, should recognize some of the great names in stock making, whose influence helped to create the most-used and sought-after stock styles of today. Among the most notable were August Pachmayr, Bob Owen, Alvin Linden, Adolph Minas, Tom Shellhamer, and Leonard Brownell, to mention a few.

Factory Stock Designs

Factory stock designs range from plain classic models without a cheekpiece (cheekrest) to attractive and functional contemporary styles like Weatherby, with its striking lines and prominent cheekpiece configuration. Factory stocks, however, can't account for the considerable physical differences among shooters. Factory stock designs accommodate the hypothetical "average" person. Drop at comb on a factory stock, for example, must conform to standardization. The same goes for pistol grip length and forearm particulars. Professional gunsmiths can alter existing stocks, somewhat like tailors who modify suits to fit their customers. In most cases, the major interest of a shooter owning a factory stock will be to change the length of pull for proper reach to the trigger. A shooter should neither stretch nor cramp his or her arm to comfortably place a trigger finger into the trigger guard. Unfortunately, long- and short-armed shooters don't fall into the "average" group when it comes to factory stock dimensions. But fortunately for them, the accomplished gunsmith can modify length of pull either by adding spacers between the recoil pad and the buttstock or by shortening the buttstock.

A gunsmith can even build or modify the pitch of a stock to suit the individual, especially the burly fellow with short, heavy arms who may have a difficult time with the factory stock. Here, *pitch* refers to the down angle of the muzzle formed by the intersection of the line of bore and a line extending from the heel and toe of the butt on rifles and shotguns.

Female shooters have special problems. Big bore rifles are seldom built with women in mind. The length of pull is generally too long. Again, the gunsmith can help by fitting the stock to the person, in this case a stock short enough to be comfortable and easy to use.

Still another group of shooters that doesn't always receive a proper share of attention is young shooters. Such an important segment of the shooting world must have guns that fit them at their given ages. "Growing into" a rifle isn't the answer. By the time a shooter is large enough to match the rifle, he or she may have lost interest in the sport. In order to have a fair chance, the young shooter should have a rifle that fits. Very

few factory rifles fit the beginner, but you can adapt some stocks to fit. One big-game rifle that fills this niche is the Model 7 Remington. This little rifle offers a good selection of calibers along with a straight-line stock that you can shorten considerably without it becoming awkward in appearance or function.

Statistics suggest that we're taller than our ancestors (on the average), which means that the average stock doesn't perfectly serve taller shooters. This is no problem for the stock maker who can add a recoil pad, spacers, or a combination of pad plus spacers. Today's shooter knows a rifle should fit and that such fit is possible through the expert stock maker who can either alter an existing stock or build a new one from scratch.

The Synthetic Stock

Since the previous discussion hinges partly on aesthetics, we should address the place of the so-called plastic stock. Most arms manufacturers now offer one of the latest entries to the world of stocks: the synthetic stock. It's also offered separately to replace existing traditional stocks. Synthetic stocks are good, and for the most part they copy some form of traditional stock in design and style. But are they works of art? Most custom stock makers would say no. However, the majority of stock artists would admit that they offer their customers a choice of synthetic or composite stock. Why? *Durability*. The synthetic stock is strong, stable, made of high-grade materials, and will last through several lifetimes of use. It requires very little maintenance aside from an occasional fresh coat of paint.

The Semi-inletted Stock

Semi-inletted (semi-custom) stocks are constructed from rough blanks, in which most of the work is completed. Several companies, including Boyds' Gunstock Industries, Richards Micro Fit, and others, supply them (Figure 3). Each company offers several different styles as well as their own unique designs. Semi-inletted stocks include wood and laminated

models. They're available in different styles, with various dimensions as well. Each company strives to individualize its product line so that we can clearly recognize its stocks.



FIGURE 3—Shown in (B) is the semi-inletted stock for the Remington 500, shown in (A). (Photo courtesy of Reinhart Fajen, Inc.)

Semi-custom stock manufacturers have built reputations by catering to the shooter who desires a stock of good quality for a reasonable price. The semi-inletted stock requires the attention of an accomplished amateur or expert to bring the stock from its original semi-inletted state to a properly fitted and finished rifle stock.

Often, the semi-inletted stock retains sufficient wood to allow a personal touch in finally forming the stock's lines into a unique piece suited for a specific use. We'll discuss the semi-inletted stock later in this unit.

The Custom Stock

The custom stock reigns supreme. It's handcrafted from a plank of wood designed in all respects to fit one shooter. A stock maker can create any style to satisfy the most discriminating customer's special needs and desires. The execution of a custom stock requires the attention of an expert stock

maker who must design, lay out, inlet, shape, and finish the plank to transform it into a functional piece of art. The beauty of the custom stock's figured wood, blended with utility, is built around one specific shooter. Perfect fit is impossible to achieve in any other than a custom stock. The end result is an extension of the shooter, which helps this person realize his or her full shooting potential.

Now that you're aware of the various types of stocks available on the market, our discussion will center on gun stock styles. In learning about the various styles, you'll come to understand much about gun stock function.

Stock Styles

Stock styles are many and varied. The modern stock's inception is without doubt linked to the muzzleloader of early America. The muzzleloader rifle stock was typified by the inclusion of considerable drop, a narrow sharp comb, and a narrow metal buttplate. Such stocks adapted well to offhand shooting with iron sights that lay close to the barrel. The style was tenacious, hanging on for many years. The muzzleloader stock didn't entirely disappear with the invention of the cartridge rifle. Many of the early cartridge rifles continued to carry features from the muzzleloader era. These rifles were often noted as "hard kickers." One example is the Model 1895 Winchester lever-action rifle, especially in caliber .405 Winchester. This one got the shooter's full attention each time the shooter pulled the trigger, especially when using heavy loads. The narrow, old-fashioned steel buttplate often left its mark on the shooter's shoulder.

A later rifle, the bolt-action Model 54 Winchester (forerunner of the famous Model 70) was an excellent piece, but it also retained more drop than necessary, a holdover from the old days of stock design. The Model 54 stock was also on the narrow side. These and other similar rifles were enhanced greatly with new stocks of better design. Savage, Marlin, and Remington also maintained original stock lines for some time following the muzzleloader days. The stocks were handsome in many ways, but they didn't adapt well to the modern rifle with its high-power cartridge.

At this juncture, a review of the basic stock styles that have evolved over the years is in order. None of these styles is stagnant. Each has been and will continue to be personalized by stock makers to express their own creativity while fitting the needs of a particular shooter.

The Classic Stock

Simple elegance typifies the *classic stock*. The style is called classic because it has endured and because it has a no-frills design. Straight combs prevail in this stock style without excessive drop at the butt or point of comb. Its *cheekpiece* is rather simple in nature, usually trailing out and tastefully disappearing into the top of the wrist (Figure 4). To accentuate the cheekpiece with a touch of class, a shadow line may be used to subtly enhance the lines.

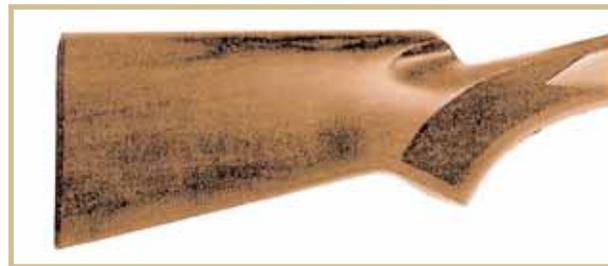


FIGURE 4—Shown are three different cheekpiece styles on classic-style stocks. The top stock is Bostogne walnut, the middle stock is maple, and the lower stock is laminated birch.

A cheekpiece isn't necessarily a functional touch, despite the fact that many current factory rifles have them. Unless the cheekpiece is quite large and protrudes considerably from the side of the stock, it contributes little if anything to an individual shooter's fit. And with few exceptions, it does little to elevate and support the shooter's face and provide a better view through the ocular of the scope sight.

In fact, consider an excellent classic-style stock built with no cheekpiece from a nicely figured plank of English walnut (Figure 5). The completed rifle was displayed in a gun shop, and customer comments were noted. Many saw it; many commented. Not one in 10 viewers mentioned the lack of a cheekpiece. This fact suggests, perhaps, that the classic-style stock doesn't depend on additions to its design. Its clean appearance stands well without extra appointments or exaggerations. However, a tastefully executed cheekpiece can augment the beauty of the classic stock style.

FIGURE 5—Shown here is a standard grade stock made from English walnut. (Photo courtesy of Reinhart Fajen, Inc.)



It's common to find a classic-style custom stock adorned with a horn or checkered steel buttplate, or a skeleton buttplate with a steel border around the butt with the center of the plate left open to expose wood for checkering. Such buttplates are for show, not durability or function.

The rubber recoil pad has found favor with many shooters who carry their classic-style custom-stocked rifles into the field and onto the shooting range. This type of buttplate lessens recoil and makes the rifle more comfortable to shoot.

Another feature of the classic-style stock is a pistol grip design leaning towards the conservative with a graceful curve not falling much below the toe line of the stock. The pistol grip may follow the previously mentioned buttplate design, with a grip cap of steel. The grip can be checkered. It can also be skeletonized, whereby the exposed wood can be

treated to checkering. Solid steel grip caps are also prominent and can be engraved. Horn grip caps are also found, but steel is more prevalent. Furthermore, there are pistol grip caps with small trapdoors installed in them. The trapdoor opens to a tiny recess in the pistol grip itself. This touch has been added to some fine classic-style custom stocks.

The forearm of the classic-style stock is normally about half the length of the barrel and well rounded in shape, slightly tapering to the end. It's common to find a forearm cap of ebony or other wood of moderate contrast fitted to the classic-style stock forend. An exceptionally beautiful piece of wood may have no forend cap at all because the addition of a cap could detract from the natural beauty of the wood. Personal preference weighs heavily on all of these points, of course. However, the classic-style stock must maintain its clean and graceful lines to qualify as classic. Skilled artisans can coax great beauty from a piece of wood styled in the classic form. Two words used earlier continue to apply: simple elegance.

The Contemporary Stock

The *Weatherby stock* comes to mind when thinking of the contemporary style. Roy Weatherby boldly broke new ground by departing from the prominent stock styles of his day. His unique design won praise both for high performance and striking beauty that departs measurably from the subtle.

The buttstocks of contemporary design have the Monte Carlo comb with prominent cheekpieces. Pistol grips are much more pronounced and larger than the classic-style stock, often with a flared style of daring design capped with highly contrasting woods. Inlaid grip caps are also common on this stock style. Forearms are more angular than the classic style and they follow geometric lines that end with a highly contrasting forearm cap. White line spacers between the forearm cap and/or grip cap are common. These touches, in most instances, are appropriate. They're at home with the overall flamboyant style of the contemporary stock. Generally, people either equally like or dislike the contemporary stock. However, this sound and useful stock style fits many shooters better than the classic-style stock.

The Thumbhole Stock

The *thumbhole stock* (Figure 6) belongs in the contemporary realm. Shooters use the thumbhole stock for silhouette off-hand shooting, with rifles of modest weight and lines, to benchrest, with rifles of blocky and square designed stock lines.

There are few guidelines to mark the thumbhole-style stock from other stocks, aside from the fact that the thumb of the shooter extends through the pistol grip itself rather than wrapping around it. Also, most thumbhole stocks have very little drop at the comb. Harry Lawson of Tucson, Arizona, has done more with thumbhole stocks than any other well-known gun maker of the era. His designs are radical, dealing heavily in contrasting woods for forearm caps and pistol grip caps and often carrying considerable embellishments, including inlays. The thumbhole-style contemporary stock isn't for everyone, but the style has a strong following.



FIGURE 6—A Thumbhole Sporter Stock (Photo courtesy of Reinhart Fajen, Inc.)

The Monte Carlo Stock

The *Monte Carlo comb* came to rifles via shotgun stocks. It rises well above the ordinary comb line of the stock at the butt and tapers downward toward the point of the comb. This raised portion of the stock lifts the face of the shooter and his or her line of sight well above the standard elevation provided by the classic style. However, the same amount of drop is maintained at the buttstock. A shooter with a long neck who often has trouble getting his or her face down far enough on the comb of the regular stock benefits from the Monte Carlo style.

The Monte Carlo is also helpful in uplifting the shooter's line of sight to better meet with the ocular lens of the telescopic rifle sight. Scopes rest higher over the barrel than iron sights to begin with, and this factor is accentuated by a scope with a large objective bell that must clear the barrel with high rings. The Monte Carlo stock is a natural when used with such scopes.

The Monte Carlo style normally has a cheekpiece. It's an important stock style to consider when trying to fit individuals who have specific physical characteristics that lend themselves to a high comb-style stock.

The Rollover Cheekpiece Stock

In many regards, the *rollover-style cheekpiece* is a spin-off of the Monte Carlo (Figure 7). Where we normally see the prominent rise at the buttstock on the Monte Carlo design, all we see on the rollover style is the rollover itself. This style is evident on a number of rifles, including the famous Mannlicher.



FIGURE 7—Shown is an elaborate rollover cheekpiece patterned after the Mannlicher rifle.

The rollover cheekpiece is large and prominent, the major point of attention on the buttstock. It makes a graceful transition from the right side to left side of the stock with the backside stylized and accentuated. The rearward part of the cheekpiece rises high to give the cheek and face solid support.

This stock style, correctly executed, gives the shooter an ideal fit, aligning his or her eye with the scope. It's imperative that the cheekpiece be properly shaped, which means making the actual point of comb the lowest part of the cheekpiece. This particular configuration allows comfortable shooting, especially with high-power cartridges that deliver heavy recoil. The style also reduces the tendency for the stock to lift up, hitting the shooter on the cheek.

It's natural to associate the rollover cheekpiece with the *Schutzen target rifle*. The Schutzen style had an elaborate and large cheekpiece created with a deep dish for the face to rest in.

The Schutzen rifle was pleasant to shoot. Chambered for low-intensity cartridges such as the .32-40 Winchester, it produces low recoil. Low recoil, combined with the heavy weight of the Schutzen, averts abuse to the shooter's face.

Today's average big bore rifle is lighter than the Schutzen, however, and it's normally chambered for a high-intensity cartridge, such as the .270 Winchester, 30-06 Springfield, or 7mm Remington Magnum. However, the rollover cheekpiece remains a good design.

The forearm style often encountered on rollover cheekpiece-style stocks generally follows contemporary lines with more squared and geometric lines rather than the forearm style of the classic rifle stock. Pistol grip caps and forearm caps of contrasting exotic woods also fit in well with the contemporary styling of the rollover design. The rollover cheekpiece stock is attractive and comfortable to shoot when its shaping is properly accomplished. However, when poorly shaped and designed, the rollover can be abusive to the shooter's face.

The European Stock

The *European-style stock* isn't particularly easy to categorize these days, as firearms from Europe are being produced with a multitude of stock designs. We can attribute the situation to the influence of American guns and gun makers. Also, Japanese manufacturers copy extensively from many stock designs, erasing certain style traits and blending others. It's becoming more difficult to isolate a given firearm by its overall design. However, the gunsmith should understand that what exemplified the European-style stock was the high narrow combs with rather long, bird-head type pistol grips with relatively short and small forearms. This somewhat simplified description stands in general, and these traits are evident on many older European rifles. The European-style stock is unique in its older form, and is clearly recognizable by an observant stock maker.

The Target Stock

There are many branches of target shooting, and each has its own and varied rules and regulations. It would require an entire book to describe the types of target stocks used today, each boasting the latest unique design feature that provides a shooter with an edge. For example, a stock built for offhand shooting used to tip metal silhouette targets will look far different than the cumbersome-looking blocklike stock that provides the benchrest rifle with near total stability. Suffice it to say at this stage that a stock builder should first direct his or her attention to basic designs, applying practical skills to master building them. Having obtained the necessary practical experience, the gunsmith might progress to specially designed target-style stock building.

The Hunting Rifle Stock

This category is much easier to deal with than target stocks. The hunting rifle must be designed to smoothly mount to the shoulder with sights aligned for rapid, but accurate, use. If scoped, the shooter should immediately see a clear picture when he or she brings the rifle to the shoulder. The stock's length of pull must be short enough to avoid the buttplate

catching at the shoulder or on clothing, but long enough to suit the shooter's build. (The length of pull is the distance from the center of the buttplate to the trigger.) Furthermore, the thumb must naturally seek a place on the stock so that thumb and nose don't come together during recoil. The rifle stock must fit correctly so the scope doesn't recoil against the shooter's eye area when fired. The hunting stock should fit the shooter so well that the rifle becomes like an extension of the shooter's body. When the stock fits well, it's second nature for the hunter to bring the rifle up smoothly and almost unconsciously. The shooter shouldn't have to consider how to hold the rifle to get a clear view of the sights.

Furthermore, stock makers must adequately proportion the stock to match the intensity of the cartridge for which the hunting rifle is chambered. Hunters may remind stock makers that they carry the rifle all day, but use it for only a second or two. However, that split second becomes the moment of truth.

Hunters who say that recoil and stock fit don't have much to do with success are wrong. The practiced shooter is the better marksman. Practicing with an ill-fitting, uncomfortable stock causes bad habits that can carry over into the hunting field. The shooter must sight and practice with a rifle before hunting. The rifle should fit well and behave under all circumstances, from the benchrest to the hunting field. Furthermore, continually shooting a rifle that delivers an uncomfortable kick can cause the marksman to develop a flinch. A flinch disturbs the shooter's accuracy whether the target is a paper bull's-eye or a bull elk. Rarely can a person take punishing recoil on or off the bench without his or her shooting ability suffering.

A large-caliber rifle demands a stock of adequate size and weight to help distribute and control the resulting recoil. Rifles of modest weight fitted with some of the newest muzzle brakes significantly reduce recoil at the shooter's shoulder. A good muzzle brake can tame a lot of recoil. Even then, however, the shooter must pay a price. Muzzle brakes of proper design work well, but they can direct uncomfortable sound waves back at the shooter. Also, many shooters who want the

ultimate in a fine-looking rifle don't appreciate the visual effect of a muzzle brake attached to the barrel, nor its extra length.

Designing a Custom Stock

No two people have the exact same stature, and in many instances, hard-to-fit physical characteristics lead to custom stock design. Of course, most people can fit themselves into standard-sized stocks—up to a point. That's why the standard stock is often a workable option. However, when the customer desires optimum fit, the stock maker develops a custom stock design plan.

Ideally, the client for a custom stock will be available to aid the stock maker in developing the design. This allows for one-on-one communication and a free exchange of ideas. It's especially helpful if the customer is present for final shaping so the stock maker can address minute details. Many times, this is impossible. So, the gunsmith must rely on his or her best judgment in perfecting a stock that will fit the customer, even if the customer is several states away. Occasionally, the stock maker must build a stock for a shooter he or she has never seen. In this situation, the stock maker works from a list of specifications.

The stock maker must address several important considerations before designing a stock to fit the physique and needs of a client. What is the shooter's physical size? Is the shooter short? Tall? So-called "medium height"? Is the shooter heavy-set or on the slim side? Barrel-chested with heavy neck, or lean? Is the shooter young? A man or a woman? Are the shooter's hands large or small? Are his or her fingers long or short? Does the customer have a physical disability that can be compensated for? These are just some of the important physical considerations the stock maker must address when developing a design plan.

What about shooting *style*? Does the customer "crawl the stock"? A shooter who tends to push his or her face far forward on the comb of the stock until thumb and nose get together might require special consideration during stock design.

Also, if the stock maker feels that the stock style selected by a customer is incorrect, they should discuss the issue before drawing up a contract. After speaking to a prospective customer, the stock maker must determine if he or she truly knows what the customer wants. It's not uncommon for a shooter to "fall in love with" an incompatible style, even though he or she hasn't tested a rifle of that type.

Some shooters may wish to mix styles, the buttstock of the classic, for example, with the forearm of a contemporary design. The stock maker should try to convince the customer to stick with one style or the other. Generally speaking, the reason a style is unique and workable is that its unique lines fit together—the design works. When you mix styles, the results are often less than desirable. Furthermore, mixing styles can result in anything but a piece of artwork. A stock of mixed style might look ugly, and will probably have reduced value on the resale market should the customer later decide to sell it.

"The customer is always right," the saying goes, yet the customer deserves professional instruction to help him or her decide in favor of correct stock design. Furthermore, the stock maker puts his or her name on the product and therefore has the right to insist upon a certain amount of input as to what the stock will and won't be.

To illustrate how all the considerations come into play in actual practice, let's discuss two of my clients.

The first client is Ron, six feet, two inches tall, weighing 190 pounds. Ron has a muscular, well-proportioned build, but has a rather long neck. His hands are large, but not overly large for a man of his size. His shoulders have a slightly sloping arc. He is an active, experienced hunter who shoots for pleasure as well as meat, spending a good deal of time at the target range.

For years, Ron has shot factory rifles that had to be lengthened with a recoil pad to gain proper length of pull. Ron likes the classic look, but he learned from experience that the classic stock doesn't fit him well. There's insufficient drop in the classic stock design for him to mount the rifle with the sights instantly coming into view.

Ron has clear options. The classic style of stock isn't entirely correct for him. He requires correct drop at the buttstock to seat the stock fully into his shoulder, while his face remains firmly and correctly placed against the comb for a steady and comfortable hold. If he insists on the classic style regardless of the facts presented by the stock maker, it would be possible to build a classic stock with considerable drop at the buttstock. Such a stock design is somewhat like the original muzzleloader stocks. A lot of drop will exist, and felt recoil management will be reduced. While hardly ideal, this compromise is possible.

Step one in making Ron's custom stock is providing correct length of pull. The well-worn rule of thumb about measuring the length from the crook of the arm to the index or trigger finger is unreliable. The person's shooting style determines the length of pull.

If the shooter crawls the stock, length of pull must be a little longer than usual or a thumb and nose may come together during recoil. Worse yet, during recoil, a scope's ocular bell may cut into the shooter's head. Ideally, I use a test rifle to help decide length of pull. I can examine how my client fits into the test rifle. From that knowledge, I build a set of specifications for a stock that fits properly.

I check for length of pull as Ron aims the test rifle. I look for all aspects of stock fit and ask questions. For example, "How does the pistol grip on this rifle suit you?" Meanwhile, I look at the position of Ron's hand on the grip to see if it seems to fit well. Suppose that the little finger of his right hand (for this right-handed shooter) slips over the bottom of the grip cap. It's obvious then that the grip should be longer on the custom rifle. In this instance, a quick measurement from the center of the trigger to the front of the pistol grip revealed that I should add $\frac{1}{2}$ inch to the test rifle's grip measurement to adapt the custom grip for Ron.

The next consideration is the pistol grip profile. Could I improve the factory profile to better fit Ron? In this case, yes. We mutually determine that the pistol grip should be located slightly more to the rear and at a somewhat different pitch or angle in relationship to the wrist of the stock.

At this point, since we're discussing the pistol grip, Ron decides on a checkered steel pistol grip cap. Specifically, he selects a Niedner cap (Figure 8). (These caps are available from several sources, such as Brownells, Midway USA, and Dakota Arms.) So far, we've determined two major factors of the stock design: length of pull and grip cap dimension and shape.



FIGURE 8—The Niedner Series 5 Grip Cap (Photo courtesy of Reinhart Fajen, Inc.)

Next, what about drop in the buttstock? Since the factory stock is fairly close to a fit, we study it again as a model. Ron shoulders the factory rifle as I look on.

Most of the buttstock is on Ron's shoulder, but not all of it. About $\frac{3}{8}$ inch more drop in the buttstock would clearly bring all of the buttplate into contact with the shoulder, so I record that measurement.

I then realize a potential problem. To incorporate the additional drop in the buttstock, the classic-style stock fades from the picture. I advise Ron that the factory stock, with its Monte Carlo cheekpiece, fit rather well (Figure 9). Ron yields to my knowledge. He, too, wants his new rifle to custom fit. So we agree that the custom stock would have a Monte Carlo, possibly with rollover cheekpiece.



FIGURE 9—A Monte Carlo with a Rollover Cheekpiece (Photo courtesy of Reinhart Fajen, Inc.)

Next, we decide on the cartridge—the 7×57 mm Ackley Improved. Because this isn't a heavy-recoiling round, the buttstock could be nominal, quite close to the dimensions of the factory rifle being used as a model.

The rifle stock begins taking shape in my mind. After jotting down specifications and measurements, I introduce for consideration the stock's front end. A simple rounded style of forearm would blend nicely with the rest of the stock and would fit the hand of this particular shooter. We don't consider

a forearm cap, as neither Ron nor I deem one necessary. A plain forearm design would serve both in the hunting field and at the shooting range.

We select a plank of wood from several choices. The conservative nature of the stock lends itself to a nice piece of Bostogne walnut that would blend with the overall tone of the rifle. A Monte Carlo cheekpiece would fit nicely on this stock, well proportioned to fit the face of the shooter and to satisfy his eye for beauty.

Next, I consider a slight pitch in the stock to keep the rifle level when Ron holds it to his shoulder. We discuss a steel buttplate, then decide in favor of the rubber pad. An Uncle Mike's Ultra Mag 1 inch recoil pad would provide shooting comfort at the shoulder.

I proceed to build the custom stock to Ron's satisfaction and mine. Before the final finish, we apply a test. I ask Ron to close his eyes and bring the rifle to his shoulder as if he were going to shoot. Then, after the rifle is in position, I ask Ron to hold that position and open his eyes. He is looking directly into the full picture of his scope's view, proving that the rifle stock fit properly.

Now, let's discuss a second client, Anne, to provide an awareness of how we determine individual stock design. Anne's stock requires *cast-off*, *toe-out*, and *pitch*, three aspects not previously discussed. Anne is five feet, four inches tall, 105 pounds. She wants a custom rifle for deer and antelope hunting only. She specifies a 6mm Remington with a 22 inch barrel, straight 6X scope—a lightweight rifle. I took all of the previously discussed measurements, starting with length of pull. After I recorded all stock dimensions, I incorporated cast-off, toe-out, and pitch into Anne's stock for better fit. Consider a *left-handed* stock in the following discussion, as Anne is left-handed.

Cast-off

Cast-off moves the vertical center line of the buttstock to one side of the plank or the other, depending on whether the shooter is right- or left-handed. In Anne's case, I moved the center line as far to the left as the plank would allow. (Some

instances don't require much cast-off.) Stock blanks are of rather small dimension today. Therefore, cast-off is generally limited to about $\frac{3}{8}$ inch to perhaps $\frac{1}{2}$ inch.

Warning: The comb line must remain parallel to the bore when the stock is shaped out or the side of the stock will drive directly into the shooter's cheek during recoil.

Cast-off causes the buttstock to align such that it's positioned more fully on the shoulder, rather than into the chest region, when the rifle is sighted. Cast-off also allows the shooter to position his or her face more directly behind the scope in a natural fashion. When the buttstock is moved to the left, more wood becomes available for use as a cheekpiece, another important aspect of cast-off. More wood provides for a cheekpiece that solidly supports the face while aligning the eye with the scope's ocular lens.

Toe-out

Toe-out was the next stock dimension aspect considered for Anne's custom rifle (Figure 10). We achieve toe-out by moving the toe of the buttstock to one side or the other (to the left for this left-handed stock). Toe-out positions the toe of the stock out and away from the chest of the shooter, rather than allowing it to dig into his or her chest during recoil. Such a situation most likely occurs when mounting the rifle hastily and firing before the butt end of the stock is firmly against the shoulder.

Pitch

Next, we consider *pitch*. Pitch is the angle of the buttstock in relationship to the barrel. When a stock has the correct pitch to match the shooter, it's almost impossible for that shooter to mount the rifle improperly. I added sufficient pitch to Anne's stock to match the profile of her shoulder. I took care to ensure that when she mounted the rifle, she would be looking directly through the scope.

Here's how to visually achieve pitch.



FIGURE 10—Shown is toe-out on a stock. Note the line of the ruler in comparison to the line of the buttstock.

Place the rifle's buttstock flat against the floor with the top of its receiver aligned with a wall. Remove the scope sight from the rifle so that it doesn't make contact against the wall. The barrel (muzzle) of the rifle will point away from the wall depending upon how much downward pitch has been added to the buttstock. The more pitch, the more the barrel will angle away from the wall. If there were zero pitch, the barrel would end up parallel with the wall. This little visual demonstration is always helpful in explaining pitch to a customer.

Furthermore, by measuring the distance between the wall and the muzzle, we can measure pitch more exactly. That measurement shows how much *downward pitch* the stock has incorporated in it in inches.

The uneducated eye may view a stock that has cast-off, toe-out, and downward pitch as "crooked." However, such factors can provide a rifle that mounts more naturally for the shooter, along with better recoil control.

Anne's lightweight rifle was a success. Anne's spouse paid me one of the finest compliments when he declared that the stock didn't fit him at all. Of course not. It wasn't built for him. It was custom-fit for Anne.

Further Considerations of Stock Design

Final rifle weight. Explain to the customer that there's no way to gain the stability of a heavy benchrest target rifle with a lightweight hunting rifle. You could build a very accurate lightweight rifle, but in the field such a rifle won't stabilize like a heavyweight. However, it will carry nicely and fulfill its function as a hunting rifle.

Consider the offhand shot. In building a custom stock, remind the customer that part of the reason you're matching the dimensions and angles of the stock to suit him or her is to achieve a fast-pointing, well-balanced rifle. Such a rifle makes offhand shooting more effective. And sometimes the offhand shot is the only one possible.

Choose the right cartridge. Cartridge choice becomes an important consideration when building a custom rifle for an individual. As mentioned earlier, a client might carry the rifle far more than he or she shoots it, so build it to carry easily. However, the shot is still the bottom line. Match the cartridge to the rifle style. While proper stock fit and recoil reducers can reduce the effect of recoil on the shooter, there are limits to such reduction.

Consider recoil reducers. Muzzle brakes, Mag-Na-Porting, and other means of helping to control recoil can produce a far more pleasant-shooting rifle. *Felt recoil*, the actual effect of recoil on the shooter, can cause flinching. Heavy recoil may also ram a scope's ocular lens into the shooter's head.

Lightweights can be too light. There has been a tendency toward super-lightweight rifles over the years. However, the fact remains that a standard-weight rifle with medium barrel has a greater propensity for stability. Remind your client that he or she can compensate for another half pound or even full pound of weight in a rifle by carrying less into the field. It may seem a feather in the gun maker's cap to build a five pound 30-06, but even with a muzzle brake, such a rifle isn't likely to be pleasant to shoot.

For example, a gun maker built a seven pound .458 Winchester for a client who was going to Africa with a professional hunter. The client shot the rifle so poorly, due to its face-smashing

recoil, that he had to borrow his professional hunter's rifle for Cape buffalo. The professional hunter wouldn't allow the client to use the .458 on dangerous game.

The big bore trend. There's a decided trend toward the custom big bore rifle, especially .416s (as well as .375s and .458s). Big bore rifles have hard-recoiling calibers. So, the gun maker must reinforce around the recoil lug, add additional recoil lugs on the barrel where called for, and add cross-bolts in back of the recoil lug that go through the stock for added strength (Figure 11).



FIGURE 11—A crossbolt on a Winchester Model 70 provides extra strength to the stock on a hard recoiling rifle.

Epoxies fortified with carbon fiber and reinforcing fibers add strength also. Naturally, perfect wood-to-metal fit also aids in recoil management so that a stock won't split out.

Buttstocks on big bore rifles should be large, which allows greater area for recoil distribution. And of course the best recoil pads should be used. Recoil pads have improved over the years and companies such as Pachmayr and Kick-EEZ have done considerable research to provide more effective pads for heavy-caliber rifles.

Stocks on heavy-recoiling rifles should have as little drop as possible. This allows recoil to come back in a straight line instead of forces angling the stock into the shooter's face. Also, less drop on big bore rifles helps to control muzzle jump.

Pistol grips on heavy-recoiling rifles should be on the long side to keep the hand farther from the trigger guard. Therefore, there's less chance of the trigger guard rearing back into the hand.

Forearms should be large enough to provide a firm grip on the rifle to help distribute recoil and better control the rifle. A white-knuckle grip on the forearm isn't advisable for accurate offhand shooting, especially on a moving target. However, the rifle of heavy recoil must be controlled differently from one of lighter recoil, and this is why a larger forearm that offers a better grip is advised.

Custom stocks come in many designs because custom rifles are built for individuals and not for that mythical "average" shooter. Furthermore, custom stock design offers a matchup between form, fit, and function. The form of the stock matches the shooter's needs. The stock fits the shooter, which provides the ultimate in rifle handling. And the custom rifle is built to perform a specific task or set of tasks. That's why there's no shortage of demand for the handmade stock. It gets the job done, with beauty.



Self-Check 1

At the end of each section of *Gun Stocks*, you'll be asked to pause and check your understanding of what you've just read by completing a "Self-Check" exercise. Answering these questions will help you review what you've studied so far. Please complete *Self-Check 1* now.

Indicate whether the following statements are True or False.

- _____ 1. The old muzzle-loading style stocks were comfortable with heavy recoiling loads.
- _____ 2. The Weatherby-style stock has striking lines and a prominent cheekpiece configuration.
- _____ 3. When designing a stock for a rifle that has heavy recoil, it's not important to consider the buttplate size.
- _____ 4. An important physical characteristic of a shooter that a stock maker should know when designing a stock is height.
- _____ 5. Factory stocks are designed for all types of people, and most factory stocks are ill-fitting and poorly designed.
- _____ 6. Toe-out and pitch basically refer to the same thing when it comes to the buttstock.
- _____ 7. August Pachmayr and Leonard Brownell helped to influence the most-used and sought-after stock styles of today.
- _____ 8. Statistics show that we're a bit smaller than our ancestors, so the trend in shorter stocks is imminent.
- _____ 9. Synthetic stocks require a lot of maintenance.
- _____ 10. Cast-off moves the vertical center line of the buttstock to one side of the plank or the other.

Check your answers with those on page 107.
