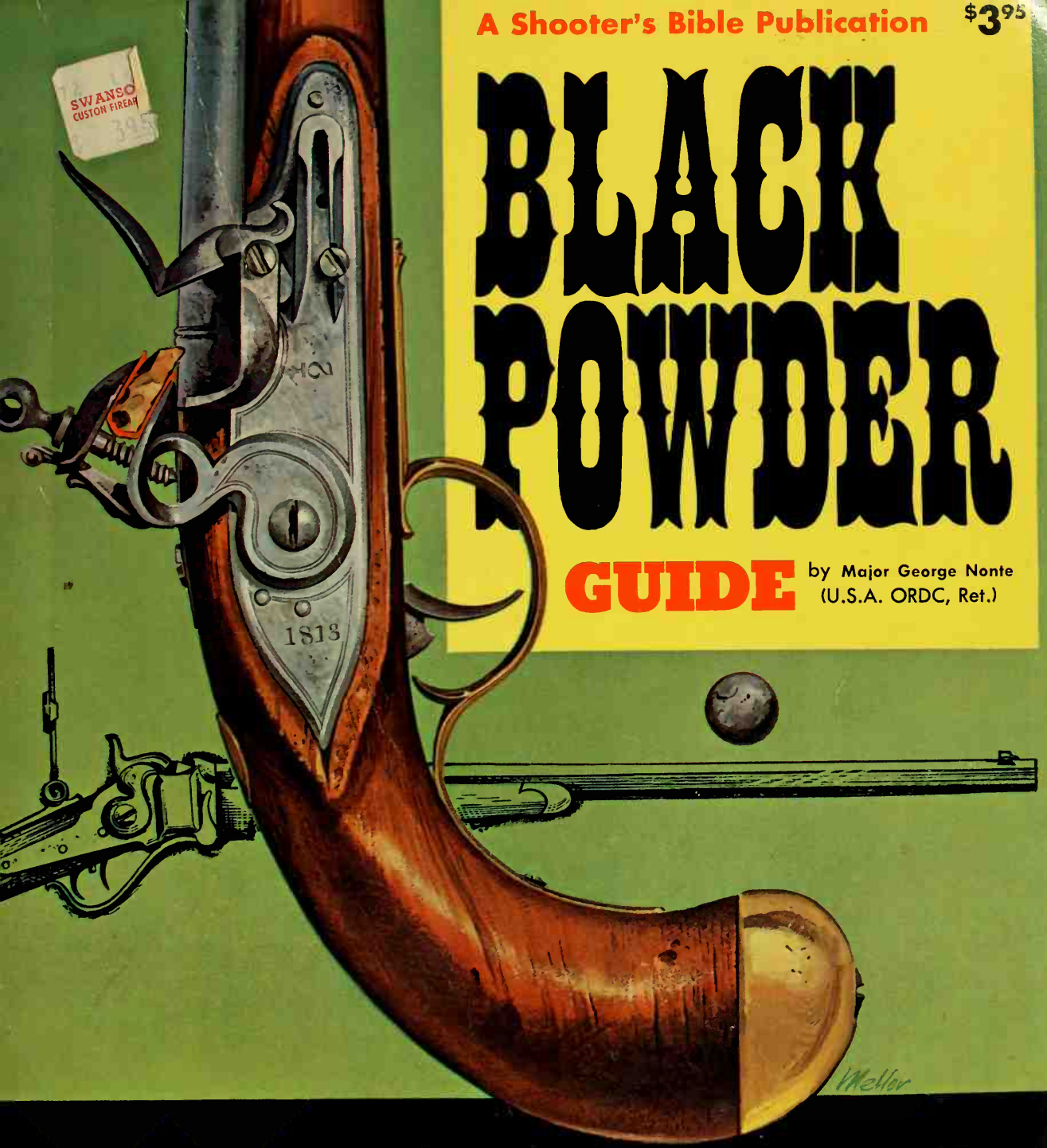


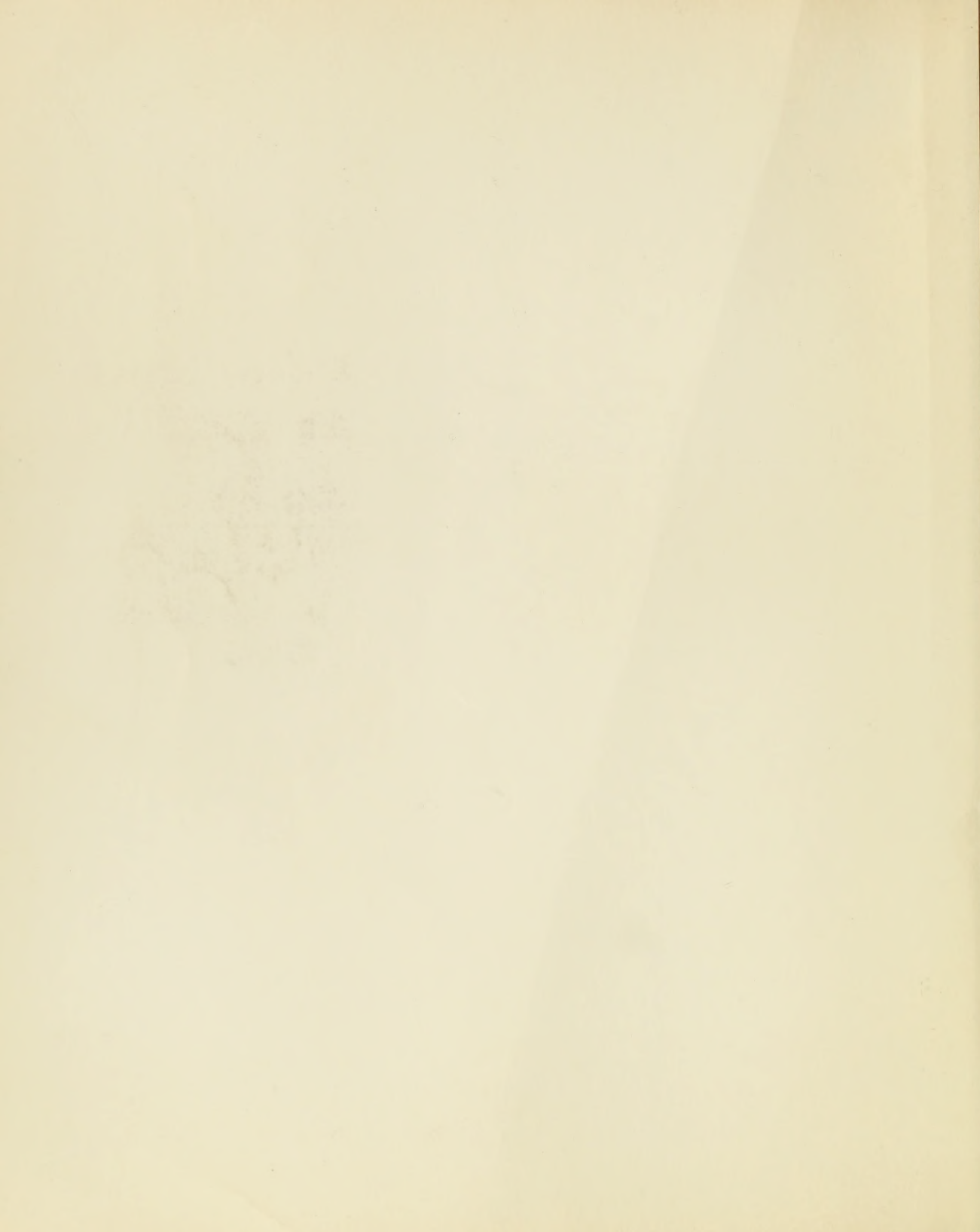
A Shooter's Bible Publication **\$3⁹⁵**

BLACK POWDER

GUIDE by Major George Nonte
(U.S.A. ORDC, Ret.)



The Complete Guide to Muzzle - Loading Rifles,
Pistols and Shotguns - Flintlock and Percussion.
How to Load, Fire, Repair and Care for Them!





Shooter's Bible

BLACK POWDER GUIDE

Shooter's Bible

BLACK
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Shooter's Bible®

BLACK POWDER

GUIDE by Major George Nonte
(U.S.A. ORDC, Ret.)

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No one writes a book all by himself. The work of others is often even more important in the end than that of the man who puts it all on paper between shiny covers. And, so it is that I feel about Sharon—the pert and delightful redhead who runs my office. Without her assistance and criticism, you'd not have seen this volume for quite a while, and would have liked it less, I'm sure. In gratitude without measure, these pages are dedicated to Sharon.

Maj. George C. Nonte, Jr.

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Foreword

The urge to do something—anything at all—with common items dating before our time is present in all of us. Some people never really give in to it; others virtually devote their lives and fortunes to things out of the past. Some become deeply involved in the past, but vehemently deny it—like the tournament archer who claims his interest lies only in the bow's challenge, and that he has absolutely no interest in the fact that the longbow was for centuries the most respected weapon of the civilized world.

But, behind the facade reared by many, the atavistic urge lurks in far more of us than will admit it. Some give vent to it by *collecting* items from the past, others by *using* the same things.

This book is for the user. The individual who, for whatever reason, seeks to emulate his ancestors' use of firearms in sport and war.

What may have been an exasperating chore for great great grandfather as he struggled to get a second shot off, takes on the aspect of pleasant recreation for his descendants. Accustomed as we are to totally reliable guns and ammunition that shoot faster, farther,

and harder than ever before, it can be a pleasant change to work out with a twin of the muzzle loader some vague ancestor carried at the battle of Vera Cruz or the Fetterman Massacre.

The old timers who could tell us how they really loaded and handled a prize "Kentucky" squirrel rifle or Enfield Minie rifle are dead and gone. Some of them put their experiences in writing, but most took their knowledge with them to Valhalla. We've gone through their writings and skimmed off what appears to be useful in shooting today's muzzle loaders; and, we've added the shared knowledge developed by the ever burgeoning groups that have been shooting the old guns since before most of us were born. This has all been put together in this volume for those of you who have (or will, eventually) succumbed to the urge to shoot with black powder, caps, and all the other romantic paraphernalia.

Here, in this volume, we've tried to put together virtually all the information one needs to at least begin to follow any one of several branches of a most fascinating game—Black Powder Shooting.

Maj. George C. Nonte, Jr.

Foreword

The first of the two main parts of the book is devoted to a general survey of the history of the theory of the firm. It begins with a discussion of the classical theory of the firm, which is based on the assumption of perfect competition and perfect information. This theory is then contrasted with the modern theory of the firm, which is based on the assumption of imperfect competition and imperfect information. The second part of the book is devoted to a detailed analysis of the modern theory of the firm. It begins with a discussion of the theory of the firm as a game, which is based on the assumption of rational behavior and perfect information. This theory is then contrasted with the theory of the firm as a social institution, which is based on the assumption of bounded rationality and imperfect information. The book concludes with a discussion of the implications of the theory of the firm for public policy.

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COVER 1

THE HISTORY OF BLACK POWDER

Shooter's Bible

BLACK POWDER

GUIDE

Shooter's Guide

BLACK
POWDER
GUIDE

Chapter 1

THE HISTORY OF BLACK POWDER

The term "Black Powder" is relatively new, and did not come into use until the latter half of the 19th Century. Tremendous strides were then made in the development of more modern and efficient explosives and propellants such as gun cotton, Cordite, and single and double base nitrocellulose powders. Prior to that time, there was only one propellant suitable for use in small arms and artillery, and it was simply called "gunpowder." It was essentially identical to what we call black powder today, and we do so only to differentiate between it and the more modern "smokeless powder," which is not really smokeless at all, in spite of the name. It produces much less smoke than black powder, but still smokes.

The origins of gunpowder are, if not lost, certainly shrouded in legend, half-truth, and vague claims and statements. Students of the subject will give you an assortment of answers on the question of just when, where, how, and by whom gunpowder was invented. While two of the principal ingredients—charcoal and sulphur—were known in antiquity, the third essential ingredient—saltpetre—was not. Consequently, we can safely assume that gunpowder did not exist until all three of its principal ingredients became known, reasonably common, and available in quantity.

Saltpetre does not exist as a natural mineral product, but is produced by the slow oxidation of organic matter containing nitrogen by atmospheric oxygen in the presence of basic substances. Micro-organisms bring about this oxidation and it is carried out in nitre-beds, made of manure or urine to supply the organic nitrogen. The raw product must then be carefully purified, and any calcium nitrate in it must be converted into potassium nitrate. This, of course, is the primitive method of producing saltpetre and is seldom encountered today except in underdeveloped areas of India and in some of the more primitive parts of the world.

Modern production of saltpetre is accomplished by a highly efficient process whereby native sodium nitrate (Chile Saltpetre) is converted on a large scale directly to potassium nitrate.

Most indications are that saltpetre became known in Europe about 1250, when it is mentioned in the works of Roger Bacon and Albertus Magnus. Their knowledge of this compound and its properties was probably obtained from Latin translations of various Arabic works. A Latin work called the "Book of Fires" (*Liber Ignium*) alleged to have been written by Marcus Graecus (Mark the Greek) describes both saltpetre and gunpowder. J. R. Partington, Emeritus Professor, University of London, states that this work is a translation not from Greek, but from an Arabic work dating around the middle of the 13th Century. It is probable that Bacon and Magnus would have had knowledge of it.

"Book of Fires" gives recipes both for incendiary compositions (which were known long before gunpowder) and for basic gunpowder in its most rudimentary form. It also distinguishes between the burning of various compounds for propulsion, as in a rocket, and explosive burning, as in a gun.

It has been suggested often that gunpowder was invented by Roger Bacon. In his "Opus Majus" of 1268, he does describe the explosion of gunpowder and a year or two later gives its composition. Bacon was apparently quite impressed with the explosive force of gunpowder, and conceived of it as a destructive device.

Other Arabic works of the early 14th Century describe gunpowder in detail, while those of 1225 or thereabouts refer only to incendiary compositions. Then, too, cannons were known in Europe as early as 1326 (date of one manuscript describing them). Obviously, the cannon could not exist without gunpowder, so we can assume that it too was well known by that time.

One Berthold Schwartz (sometimes referred to as "Black Berthold") has frequently been credited with the invention of gunpowder in the middle 14th Century. This legend doesn't hold water when we consider that Roger Bacon described it, its effects, and its manufacture a century earlier. Then, there are oriental manuscripts of earlier times that describe a number of fireworks and incendiary compounds. Often these are

mistaken for gunpowder, but evidence that any of them were used to propel a projectile from a closed tube (other than fireworks of the Roman Candle type) is significantly lacking.

While it is quite likely that scholars will continue to argue vigorously, supporting various sources and dates for the invention of gunpowder, our best educated guess would seem to place it in Europe between 1225 and 1250. The exact date will probably never be known, and isn't really essential to our purposes here. It is sufficient for us to know that gunpowder dates back at least seven centuries.

In its earliest form, gunpowder differed considerably from the black powder we know today. It consisted of a *mechanical* mixture of charcoal, sulphur and saltpetre. The three ingredients were ground separately to a fine powder, and then stirred together. This form had several disadvantages. For one, it tended to absorb large quantities of moisture from the air—particularly important where sea-borne weapons were involved. In addition, the various constituents of the powder tended to become separated if the material was agitated much, as it would be in transportation on a supply wagon or on board a rocking, rolling ship. Ignition of this fine, mechanically-mixed powder could also present a problem if it were packed tightly in the gun.

Numerous methods were explored to eliminate some of these disadvantages. Careful storage, frequent turning of containers, adding powdered quick lime to the mix, even on-site mixing of the three basic ingredients were all tried in varying degrees and with varying success.

Eventually, it was discovered that by forming the powder into grains or granules (corning) that the powder's proclivity to absorb moisture could be greatly reduced. Corned powder is thought to have been invented in the 15th Century. Whether it was the result of direct effort or simply observation of the behavior of lumpy powder it is not known.

There is evidence that some attempts to reduce the moisture-absorbing characteristics were made by heating the powder until the sulphur therein melted, forming lumps. This could hardly have been considered a very safe treatment for even a crude, rather weak explosive mixture.

Corned powder produced greater explosive force than the powdered mixture. It not only reduced the amount of moisture absorbed, it eliminated any separation of ingredients, and provided easier and more uniform ignition. Because of its greater force, guns had to be cast of better materials and in a more perfect manner to withstand the force of the explosion. We really don't know which came first—corned powder, making better guns necessary, or better guns, making the use of corned powder possible.

By the early 19th Century, it had been discovered that larger powder granules were more suitable for

artillery use. Likewise, it was discovered that small granules burned faster than large. Consequently, the mixture was formed under pressure into hexagonal prisms of different sizes, according to the bore of the cannon in which they were to be used. Some experiments were conducted with large cakes of powder that closely fitted the bore of the weapon. Powder composition was also varied somewhat for artillery use, "Brown" powder being made from charcoal not quite completely carbonized. Powders of this type remained standard for artillery use until the advent of smokeless powders at the end of the 19th Century.

Early gunpowder consisted of widely varying formulas. Some, particularly oriental mixtures, contained the basic ingredients of charcoal, sulphur, and saltpetre—but contained all manner of other ingredients according to the temperament of the maker. A fair amount of wizardry or witchcraft was associated with gunpowder in its earliest days, and one recipe contains, "It is useful to add a spider skin." Roger Bacon's formula of about 1260 was saltpetre; sulphur; charcoal; in the proportions 7/5/5. By 1350, the English formula was 6/1/2. At the same time, the Germans used 4/1/1. In 1774, the Prussian mix was 8/1/1, but shortly after 1800, the various formulas tended toward a fairly standard 75/10/15 or 75/15/10. During the early 19th Century, England used the same formula for powder for all types of arms, while some other countries varied the composition slightly between sporting, military small arms, and artillery usage.

Gunpowder is still manufactured in substantial quantities today, and to essentially the same formulas that were in use in the 19th Century.

Black powder of today is manufactured in essentially the same fashion as it was after corned powder became standard. The three major ingredients are chosen for their purity and are then ground separately into a fine powder. Originally the grinding was done in water-powered stamp mills, but more sophisticated and efficient means of grinding are used today.

When properly pulverized, the ingredients are mixed together in the proper proportions with water and alcohol. The mix is thoroughly incorporated in a mechanical mixer, care being taken to insure that the proper moisture content is maintained. Should the moisture content be allowed to get too low, an explosion becomes likely. Early powder mills were considered rather expendable because of the explosion danger and were quite lightly and cheaply constructed for that reason.

After being thoroughly mixed, the wet powder is compressed into solid cakes. These cakes are then torn apart by wood or non-sparking metal tools. And, in some processes, again compressed into cakes. Following this, they are broken into smaller chunks and granules by rollers. Eventually, it is broken down into rela-

tively small granules and dried. It is not dried to the point where absolutely no water remains, but down to a point where the moisture content will remain reasonably stable.

At this point, the powder is glazed. This is accomplished by tumbling the powder in a large drum in which has been placed a small amount of graphite. The graphite serves several purposes—it prevents the discharge of static electricity which might ignite the powder mass; causes the granules to flow smoothly and easily through measuring and packaging equipment; and by coating the grains reduces the formation of dust. When the glazing operation is completed, the granules have lost part of their jagged, irregular look, and are somewhat polished and rounded, though still irregular in shape.

The considerable amount of dust generated by the tumbling/glazing operation is removed. Following this, the powder is screened to separate it into the four most common granulations fg (largest), ffg, fffg, and ffffg. This is done by running the powder over successfully finer-mesh vibrating screens. Powder that will pass through the fg screen but will not pass through the ffg screen is channeled off and packaged and sold as ffg granulation. The same procedure is followed for the other sizes. Powder too fine even for use as ffffg is salvaged, while that too large for fg may be further broken down and rescreened, or it may be sized for particular special purposes, such as use in loading blank cartridges for artillery pieces.

Gunpowder manufacture in America dates back less than 300 years. In 1675, there is known to have been a small powder mill at the town of Milton near Boston. Prior to the existence of this mill, the colonists were dependent entirely upon powder brought laboriously from Europe, primarily England, and exposed for weeks to the deteriorating effects of the sea. Though its output of powder was undoubtedly small, the Milton mill can quite likely be credited with reducing the effect of the Wampanoag Indian attack on New England. In 1675, King Phillip, Chief of the Wampanoags, launched an all-out attack against New England that resulted in the destruction of 13 Colonial towns. Without an adequate local supply of powder, it is conceivable that the colonists might have been wiped out completely.

With characteristic thoroughness, England had restricted powder manufacture by the colonies, and apparently took care that no great store of British powder could be accumulated in New England. These factors combined with the obviously superior quality of English powder, which resulted in most colonists preferring it, resulted in the colonies entering the Revolutionary War without any efficient and productive powder industry. As if this was not enough, sulphur could be obtained only from Europe, and production of saltpetre was indifferent. Thus, the colonies were

able to supply only charcoal of the basic ingredients for gunpowder. On one occasion, at the beginning of the war, General George Washington stated, "Our situation in the article of powder is much more alarming than I had the most distinct idea of."

This appalling state of affairs could not be allowed to exist if the war were to be fought to a successful conclusion. Yankee ingenuity proved itself equal to the task. Small powder mills sprang up all through the forests and nearby manure piles became nitre beds to supply the very necessary saltpetre.

One such mill was hidden in the forest near Morristown, New Jersey, while another—operated by a woman, Mary Patton, no less—was situated in Tennessee. The latter mill figured decisively in the defeat of Colonel Patrick Ferguson at Sycamore Shoals. Five hundred pounds of powder from that mill were distributed *free* to colonial troops opposing Ferguson when it became known that they were short of powder.

Many of the smaller mills disappeared with the end of the Revolutionary War, and doubtless some of them were destroyed by accidental explosions. Even so, enough survived that in the last decade of the 18th Century, the bulk of the newly-free states' gunpowder needs were supplied by domestic manufacture. European and British powders continued to be considerably superior to the colonial product, primarily because the powder industries there had become highly developed and experienced over a period of many years. While no doubt the New Englanders would have preferred to use the better imported powders, the domestic product was sufficiently cheaper that few of them did so. At this point, enter one Irenee duPont. This young gentleman was in America for the purpose of promoting the creation of a French Colony in Virginia. However, it is alleged that he became very dissatisfied with the quality of American powder he was forced to buy while on a hunting expedition. Having worked in French powder mills and laboratories, he was certainly qualified to judge the quality of this powder, and also to know that if better powder were produced in America, its maker could expect to prosper. He reasoned that a lasting powder industry would be more productive than a new colony.

Suiting thought to action, the first duPont powder was produced near Wilmington, Delaware, at Eleutherian Mills, on the Brandywine River in 1804. The competition notwithstanding, E. I. duPont deNemours and Co. had become the leading American gunpowder producer by 1810.

Older mills fell to the superiority of duPont powder, and some disappeared in thunderous explosions. Eventually three companies, duPont, Laflin & Rand, and the Hazard Powder Company became the "Big Three," dominating the American powder industry. When the American Civil War came along, the North was plentifully supplied with powder and the facilities for its

manufacture. Following the Civil War, American powder was of such good quality and in such plentiful supply that it began to be exported to Europe; thus, reversing the situation of only a few years earlier.

The Confederacy, however, was not so well off in regards to powder. The Sycamore Powder Mills, near Nashville, Tennessee, later to be taken over by duPont, was to supply considerable powder to the Confederacy. The only other mill south of the Mason-Dixon Line apparently made no significant contribution to the cause.

As the war progressed, the "Confederate Gun Powder Factory" was established and operated at Augusta, Georgia, by a West Point graduate, Colonel George W. Rains. Though never truly plentifully supplied with gunpowder, the Confederacy did manage to produce a great deal during the war. That this was not accomplished easily is evident from the tales told of southern ladies being requested to save the contents of their chamber pots to be used in the manufacture of saltpetre—the item most often in short supply.

Little known today is the California Powder Works which was established as the result of a federal prohibition of powder shipments by sea to the West Coast. The danger of capture by prowling Confederate Warships hungry for just such a prize made the risk too great. Since it was absolutely essential that powder be available in California, entrepreneurs there formed the California Powder Works, to be operated primarily by cheap oriental labor and to use saltpetre imported from India. This plan did not produce its first powder until 1864, but continued in operation for many years

thereafter. In fact, the first smokeless powder accepted for use by the United States Army was developed there by W. C. Peyton. "Peyton" Powder, as it became known, was a composition of nitroglycerin, nitrocellulose, and ammonium picrate.

Even though smokeless powder began replacing "gunpowder" in the last decade of the 19th Century, demand for black powder continued quite strong through the first decade of the present century. Even then, black powder did not disappear entirely from the scene.

The various sporting arms designed and manufactured during the "Black Powder Period" required continuous supplies of the proper ammunition. In addition, in many parts of the world, black powder arms were the only ones allowed by law, or the only ones economically feasible for the inhabitants. These markets required a continuous supply of black powder.

At no time, even today, has the demand for black powder dropped so low as to entirely justify its discontinuation. Where literally dozens of makes were once available, only the familiar red, white, and black duPont label survives today. The industrial giant fathered by Irenee duPont in 1804 continues to supply the charcoal, sulphur, and saltpetre propellant without which we couldn't shoot our muzzle-loaders today—or, for that matter, justify the writing of this book.

And so, nearly seven and one-fourth Centuries after Roger Bacon described his new compound which "thunders and lightens," it is still available, and contributing, in at least some small way, to man's enjoyment of the good life.



Chapter 2

GENERAL

It hasn't been so long ago that our great grandfathers, even grandfathers, depended upon the black powder muzzle-loading gun for food, war, and sport. Many's the grizzled oldster who regaled my generation (in its younger days, of course) with assorted and wondrous tales of the front loader's accuracy and efficiency. In the halcyon years after the Civil War, there was shooting aplenty west of the Mississippi. There were plenty of spirited lads long used to the ways of war, eager to search out hostile and forbidding territory. And, there were plenty of hard cases who felt the world was their oyster and only needed opening to get at the meat. If they opened it a bit roughly and lawlike citizens responded with irritated gunfire, the muzzle loaders were likely to get quite a workout.

Contrary to what screen, television, and novel writers would have us believe, the westward migrants weren't armed with braces of Colt single-action cartridge revolvers and 1873 Winchester repeaters. The muzzle loader, be it pistol, rifle, or scattergun, was the dominant arm in the frontier country for yet quite a few years after the Civil War. Most men walked away from the war with their guns, and only a very small percentage of the arms issued on both sides deviated from the standard caplock form. Men used the guns they had—usually a rifled musket and/or a revolver, both of caplock percussion and loaded from the front. In the late 1860's and 1870's, there were far more muzzle than breech loaders in the hands of western settlers.

With this background, it isn't hard to understand why today's affluence and leisure time has prompted great interest in muzzle-loading shooting over the past decade or so. Of course, the interest hasn't risen just in that period of time. A small group of hobbyists has been shooting muzzle loaders by preference even from the very beginning of the cartridge era. During the pre-WWII Period, there was a fair number of black powder fanciers who held regular shoots around the country. At that time, there were also still quite a few old-time gun makers who produced fine rifles in small shops throughout the South. Most of them operated with

traditional tools and methods, even to rifling barrels completely by hand and casting their own stock furniture. Some refused to use any "store-bought" components and even fabricated their own locks from steel stock. Each maker produced only a few guns per year, and to try to rush one on an order was to (probably) make certain your gun *wouldn't* be the next one finished. These fine old gentlemen almost invariably turned out "Kentucky" rifles, along with a few heavy bench-rest guns. There simply wasn't a demand for handguns or scatterguns.

The guns produced in those golden years weren't "replicas" or "reproductions" as we use those terms today. They were the real thing, authentic and original in every respect. They were hand-made with tools that had actually been used to produce identical guns before the time of the cartridge. To call one a *copy* would be to risk getting a rifle barrel bent over your head. Each smith built his "Hawg Rifles" exactly like his daddy and granddaddy had done on the same tools and in the same little leanto shack.

By the end of WWII, not many of those oldsters were still with us. And by the end of the Korean War, virtually none of the old-timers were left. Fortunately, a few younger fellows took up the trade, though using more modern methods.

Others may rightly claim some of the credit, and I don't really know who took the first steps. But in the middle 1950's, William B. Edwards, then editor of GUNS Magazine, convinced a few people that modern-production percussion revolvers would sell well enough to make a tidy profit. He traveled to Europe and located manufacturers willing and able to make the guns.

The outgrowth of Bill's efforts was the formation of Navy Arms Co. and Centennial Arms Corp. Navy started with the basic Remington percussion revolver design manufactured in Italy. Centennial, somewhat later, had the Colt 1860 .44 Army design produced in Belgium. Oddly enough, the firm producing Centennial guns had once been licensed by Colt to produce percussion revolvers.

Both firms were almost instantly able to sell more guns than could be obtained from the fabricators, a condition that continues to exist even today. Even though production capacity was continually increased, the demand for new, straight-shooting copies of original percussion revolvers far exceeded Edwards' estimates. Both firms soon followed with additional models, significant among them being Navy's Italian-built reproduction of the Remington .58 caliber "Zouave" rifled musket of the Civil War. It has since become the most widely sold replica percussion long gun of all.

Eventually, several other firms entered the replica business. With the exception of a few small shops specializing in a limited output of higher-than-average quality work, all replicas were and are manufactured in Europe, principally in Italy and Belgium.

In the beginning, there was considerable objection to the sale of replica arms. This was generated primarily by collectors' concern that unscrupulous individuals and dealers might use the economically-priced replicas as the basis for faking rare costly guns. Insofar as I have been able to determine, these fears were groundless. In the beginning, the replica companies specified certain deviations from the original guns being copied. Rifling, for instance, is quite different in most cases from that originally used. Finishes are different, as are materials. Production methods and tools also differed. Consequently, reworking, for example, a Centennial M1960 Army sufficiently to fool a collector into believing he was getting an original *Colt 1860* would involve more work than could be justified by the potential return. The following would have to be accomplished: replace barrel with an exact Colt copy; remove tool marks and duplicate original marks; completely refinish, duplicating Colt methods; remove replica markings and replace with correct ones; re-number in proper series. All of this would cost more than could be gained by a fraudulent sale. And, the altered gun could still be identified as spurious by a serious Colt student.

Essentially the same may be said for virtually all of the production model replica guns being sold today. For all practical purposes, the replica muzzle-loading gun has not been responsible for any significant increase in the faking of true collector's items.

With better than a half-dozen firms engaged primarily in the production and importation of new percussion and flintlock guns, it can be honestly said that we have a "Replica Industry." The availability of such guns has been responsible for vastly increased muzzle-loading activity—and the demand so generated has resulted in more and better guns.

Following this paragraph you will find listed and pictured the principal models produced and sold by the major firms involved. This does not purport to be an absolutely complete list of either models, makers, or sellers, but it is as nearly current as circumstances will

allow. Note that not all of the guns mentioned are actually replicas of any particular make or model. They are simply functional muzzle loaders of the various basic types and bear some resemblance to certain early arms. All of the firms listed have catalogs and/or brochures available on request and their addresses are listed in the Directory in Appendix 2.

CENTENNIAL ARMS CORP.

CENTENNIAL ARMS CORP.: This firm was formed in the middle-late 1950's, purely for the purpose of having produced abroad modern copies of muzzle-loading guns for sale here. The first item was called "New Model 1960 .44 Army" and was an accurate physical copy of the original Colt 1860 Army revolver. Care was taken that the gun differed from the original enough to avoid confusion. Orders immediately surpassed the capacity of the Belgian factory to produce guns. The factory, incidentally, had at one time been licensed by Colt to produce percussion revolvers so, after a full century, was back in production of the same item. Eventually, other replica arms were added to the line and are offered today, as listed below:

NEW MODEL 1960 .44 ARMY: An accurate copy of the original Colt, 1860 Army. Eight-inch barrel; hammer, frame, and rammer case hardened in colors; cylinder, barrel, and back strap blued, guard silver plated; round rebated cylinder, engraved scene; one-piece smooth walnut grips.

HARPERS FERRY: Copy of the Model 1805 .54 caliber U.S. Martial flintlock pistol dated 1807 and manufactured at Harpers Ferry Arsenal. Ten-inch rifled barrel, 16" long overall; bright barrel, polished brass furniture; lock case hardened in colors; polished walnut stock. Fully shootable with patched round ball.

VIRGINIA FLINTLOCK: Identical to Harpers Ferry Model above except lock plate marked "Virginia" instead of "Harpers Ferry"; metal swivel ramrod; and minor detail changes.

TOWER PISTOL: Copy of the basic British military flintlock horse pistol in use during the late 18th Century. Smoothbore, .69 caliber; bright barrel and lock; brass furniture, walnut-finish stock. Primarily a decorator.

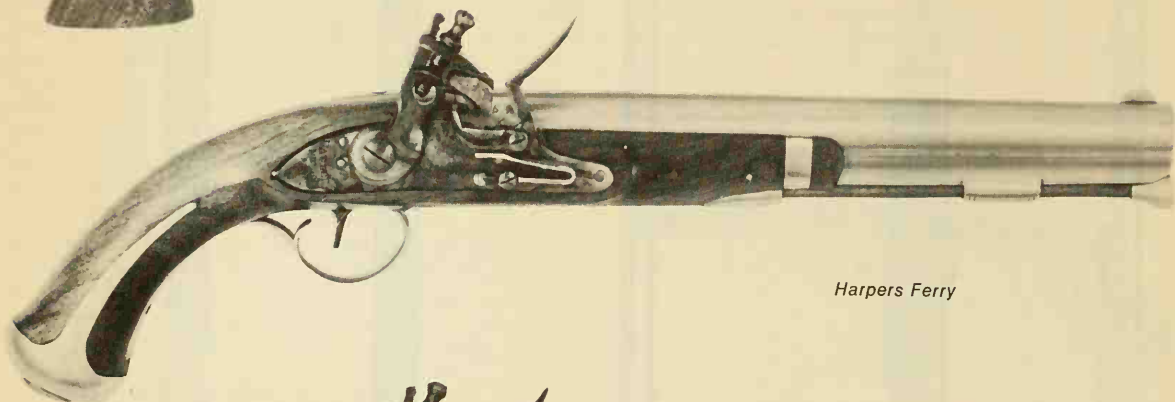
COACH BLUNDERBUSS: An accurate rendition of the general type flared-barrel flintlock blunderbuss. Only 27½" long overall; bright barrel and lock, blued guard and furniture; ebony-finish stock. Shootable.

HOPKINS & ALLEN (NUMRICH ARMS)

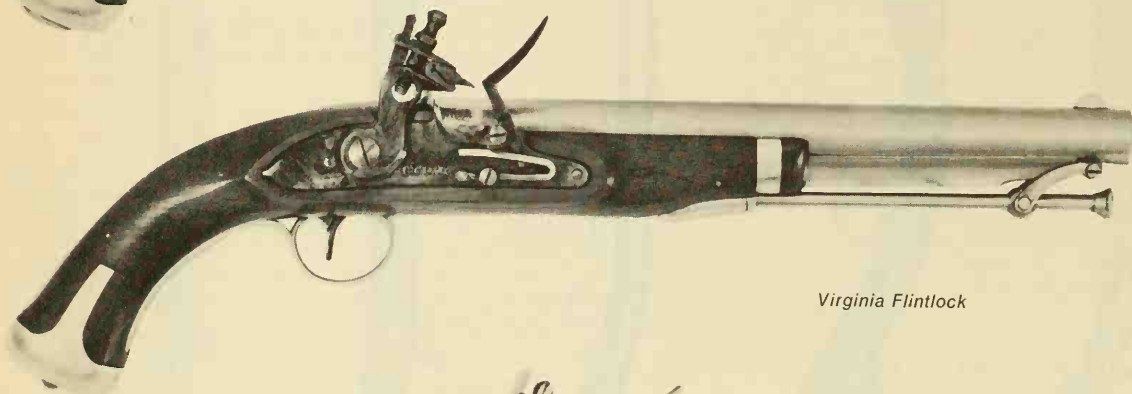
HOPKINS & ALLEN (NUMRICH ARMS): The Hopkins & Allen name dates well back into the last century when it was known as a producer of good



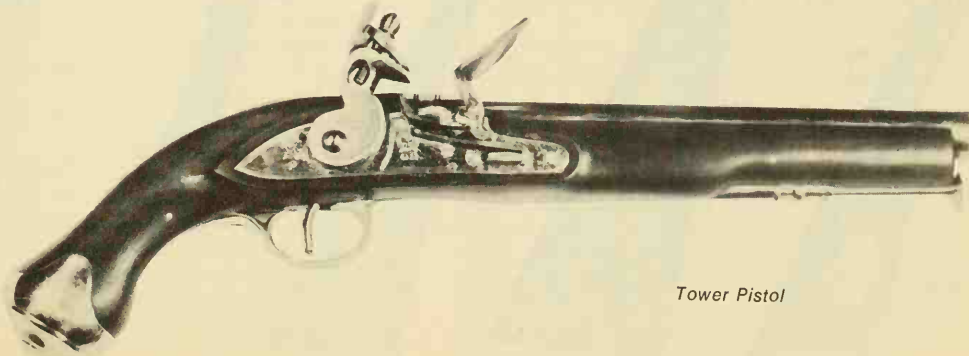
New Model 1960 .44 Army



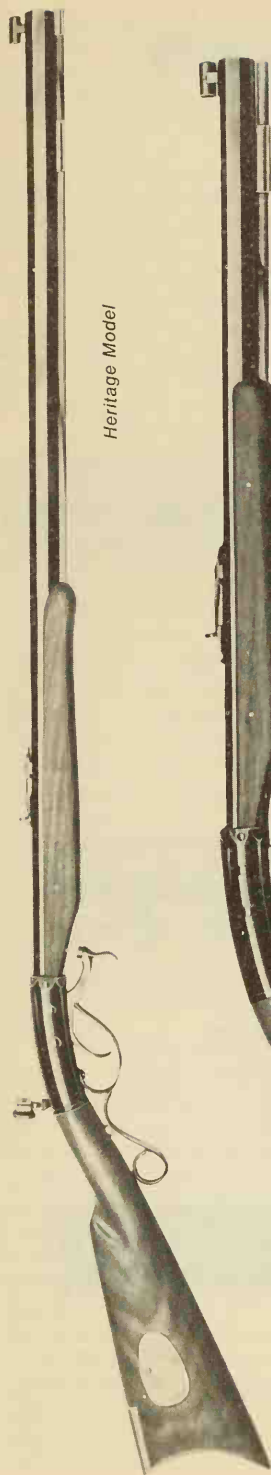
Harpers Ferry



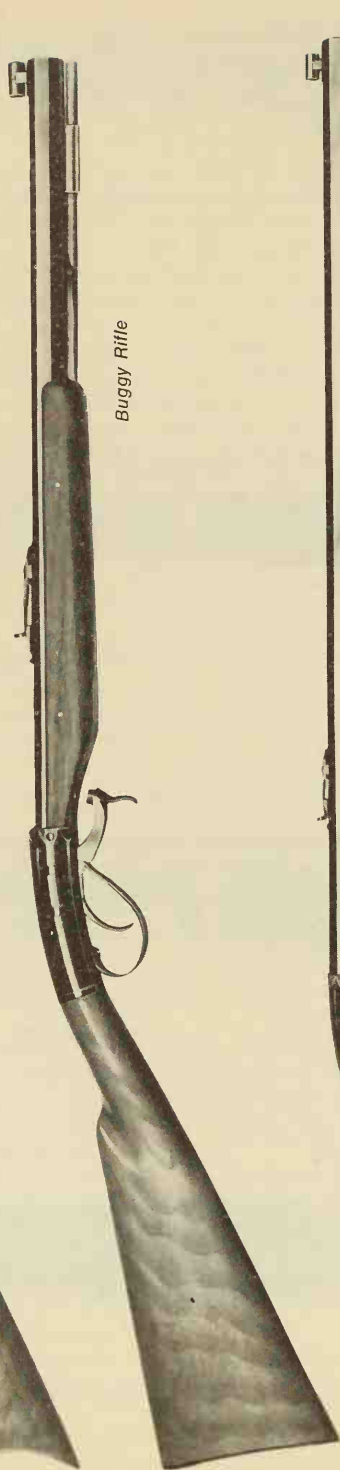
Virginia Flintlock



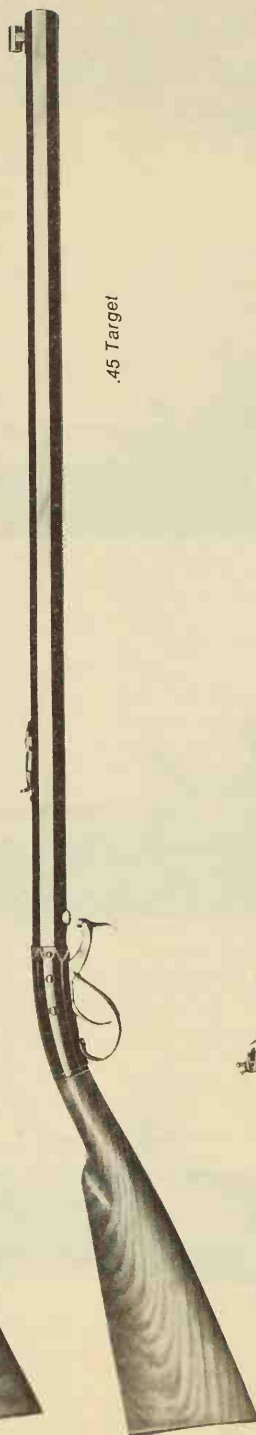
Tower Pistol



Heritage Model



Buggy Rifle



.45 Target



Minuteman



Minuteman with Percussion Lock

quality long and short guns at moderate prices. Though the company had a long and successful history, it passed from the active list before WWII. Eventually the name and assets were purchased by Numrich Arms Corp. of West Hurley, New York.

Beginning some years back, Numrich began producing a basic underhammer percussion rifle under the H & A name. It was not intended to be a replica, but rather a genuine shooting arm. The success of that item spawned an extensive line of underhammer guns based on the same design, as well as traditional long muzzle loaders and a comprehensive line of accessories.

Of special interest are the muzzle-loader barrels and breech plugs offered at most reasonable prices. Also, I believe H & A was the first to offer "Instant Muzzle-loader" kits. They consist of a caplock barrel that drops directly in the stock to replace the barrel and breech of the Springfield Trapdoor .50 and .45 caliber rifles. An old trapdoor can be converted to an excellent muzzle loader in just a few minutes. Bullet molds, sights, powder horns, nipple wrenches and ready-to-fit patch boxes round out the H & H line.

HERITAGE MODEL: Top of the H & A underhammer gun line, fitted with walnut fore-end and brass buttplate and patch box. Barrel is 15/16" across the flats, 32" long, available in .36 or .45 caliber, uniform or gain twist rifling. Hooded aperture front sight, elevator leaf rear, and long-range aperture tang sight. Weight, 8 1/4 lbs. in .36 caliber, 8 lbs. in .45.

OFFHAND DELUXE: Same barrel and action as above, but without brass fittings and long-range sight. A good hunting rifle.

BUGGY RIFLE: Virtually identical to the Offhand Deluxe, but with short 20" barrel for close quarters use in brush or timber. Weight, 5 3/4 lbs. in .36 caliber, 5 1/2 lbs. in .45.

.45 TARGET: Heavy target barrel, 1 1/8" across the flats. No fore-end or ramrod fittings, action and stock same as above guns. In .45 caliber only, 56" twist. Open rear sight, hooded aperture front. This gun has frequently outshot custom-made rifles costing many times as much.

MINUTEMAN: A traditional style pinned-barrel flintlock Kentucky rifle but not an exact copy of any make. Barrel is 39" long, 15/16" across the flats, available in .36 or .45 caliber with uniform or gain twist. Silver blade front sight, low notched rear. Maple full stock with brass buttplate, patch box, and furniture. Weight in .36 caliber, 9 1/2 lbs., .45 caliber, 9 lbs.

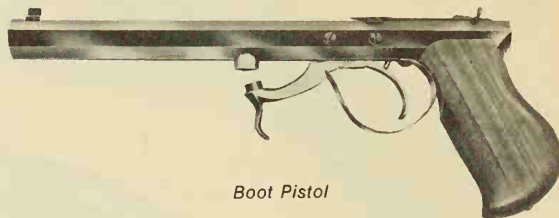
The Minuteman is also available in percussion lock form, all other specifications remaining the same. Interestingly, this gun uses the Minuteman flintlock converted to percussion, just as it was done many years ago.

CONVERSIONS: The .58 caliber unit consists of a new chrome-moly steel barrel fitted with breech plug, bolster and musket nipple, in the white, without sights.

Barrel is 40" long, 1.25" diameter at breech, .775" at muzzle. And 8-groove rifling, .575" bore diameter, 1 turn in 72". This unit will replace the barrel on all U.S. M1855 through M1864 Springfield Muskets. Will also replace breech and barrel of Trapdoor .50 caliber Springfields up to 1870.

The "Instant Muzzle Loader" consists of a 39" long barrel, breech plug and nipple unit that replaces the breech and barrel of all Trapdoor Springfields in .50-70 or .45-70 caliber after 1870. Polished and blued, dovetailed for standard H & A sights. In .45 caliber only, 8-groove rifling with .445" bore diameter, 1 turn in 56".

The "Zouave" barrel is fitted with breech plug and nipple and replaces the original barrel of M1841 Mississippi and Remington .58 caliber rifled muskets. Bore diameter .575", 8-groove rifling, 1 turn in 72", 33 1/2" long. Polished and blued, fitted with front sight, drilled and tapped for rear sight.



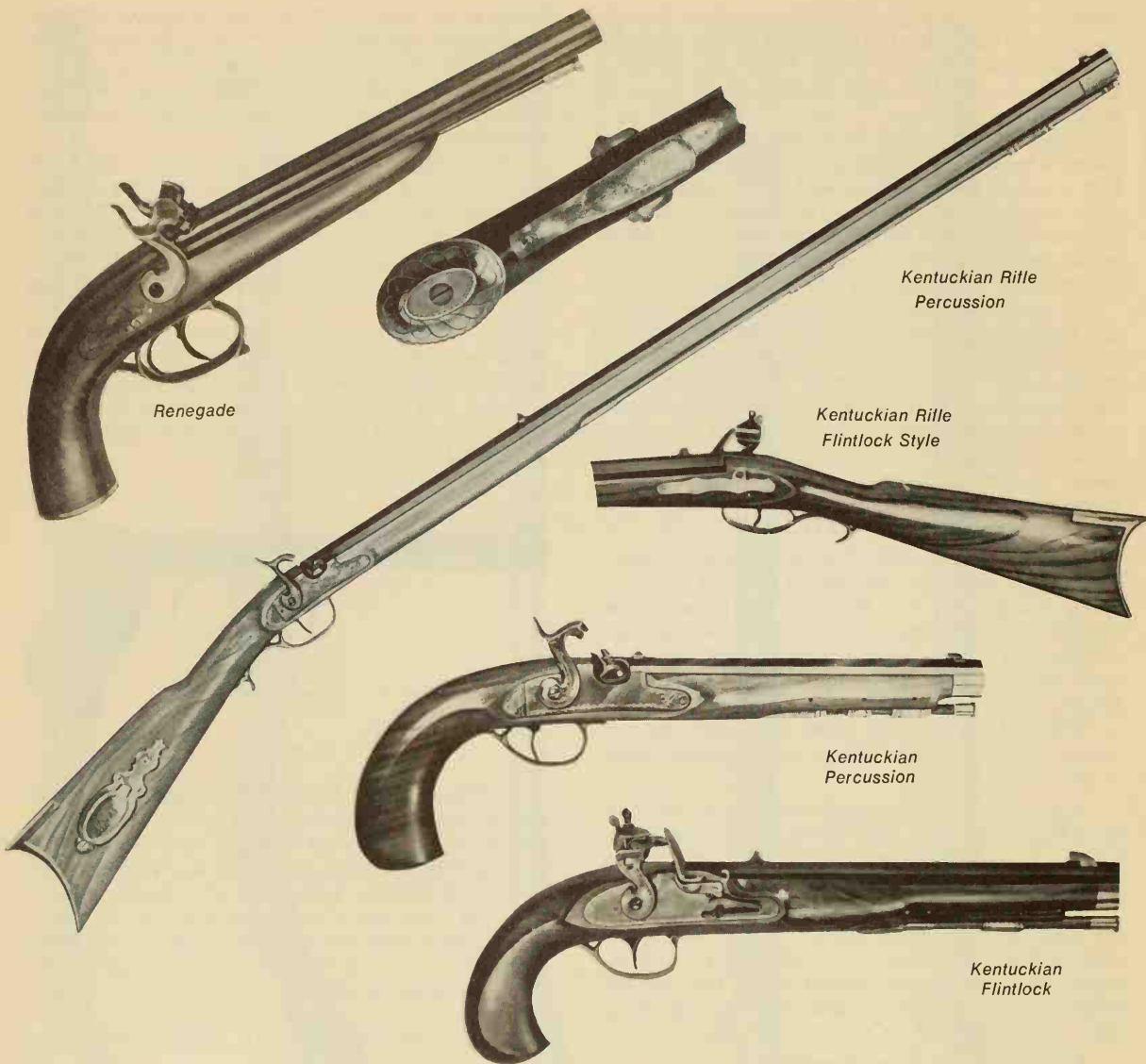
Boot Pistol

BOOT PISTOL: Probably the simplest and most durable percussion pistol on the market today, representing an unusual design approach. A single octagonal steel bar is machined at one end to accept the standard H & A underhammer lock parts and a one-piece walnut grip. The other end is bored and rifled to .36 or .45 caliber. Open sights are fitted and finish is blue. Overall length 13", barrel length 6". An exceptionally accurate pistol for the price.

INTERCONTINENTAL ARMS INC.

INTERCONTINENTAL ARMS INC.: This firm imports a variety of single-action revolvers and derringer pistols from Italy—all metallic cartridge arms. In addition, however, it brings in a wide variety of muzzle-loading guns of modern manufacture, both flint and percussion. This firm makes no wild claims, saying simply that its guns are good buys for the prices charged. That is the way I've found them to be.

In addition to both handguns and long guns, Intercontinental distributes a line of muzzle-loading accessories that includes plain and adjustable powder flasks; combination nipple wrench and tool; bullet molds; and presentation-type cases for all of its short guns.



Here are the principal Intercontinental Arms models:

RENEGADE: An economically priced double-barrel percussion pistol proofed for shooting. In .36 or .44 caliber; 8¼" barrels, 13¼" overall; 31½ oz., weight; color hardened locks; blued barrels; some engraving; walnut stock with grip cap.

KENTUCKIAN: Traditional style Kentuckian percussion pistol in .44 caliber. Octagonal 9½" barrel; 15¼" long; 38 oz., weight; walnut full stock with brass furniture; color hardened lock; blued barrel. Takes No. 11 caps.

Also available in flintlock style at same price, .44 caliber; about 2 oz. heavier.

Both versions available in fitted case with nipple wrench, mold, flask, and cutout to hold a 1-lb. can of black powder.

KENTUCKIAN RIFLE: Traditional Bedford country style percussion rifle in .44 caliber. Octagonal 33½" barrel; 58" long; 6¼ lbs.; color hardened lock; engraved lock plate; walnut stock with brass furniture; oval patch box; blue finish; takes standard No. 11 cap.

Also available in flintlock style at same price.

NAVY ARMS CO.

NAVY ARMS CO.: This company came into being in the 1950's to procure and market foreign-made replicas of the more popular Civil War percussion guns. It was formed by Valmore Forgett, Jr. and has since grown until it offers an extensive line of both handguns and shoulder arms loaded from the muzzle. If memory serves me correctly, Navy Arms was the first firm to offer production-run replicas of percussion revolvers.

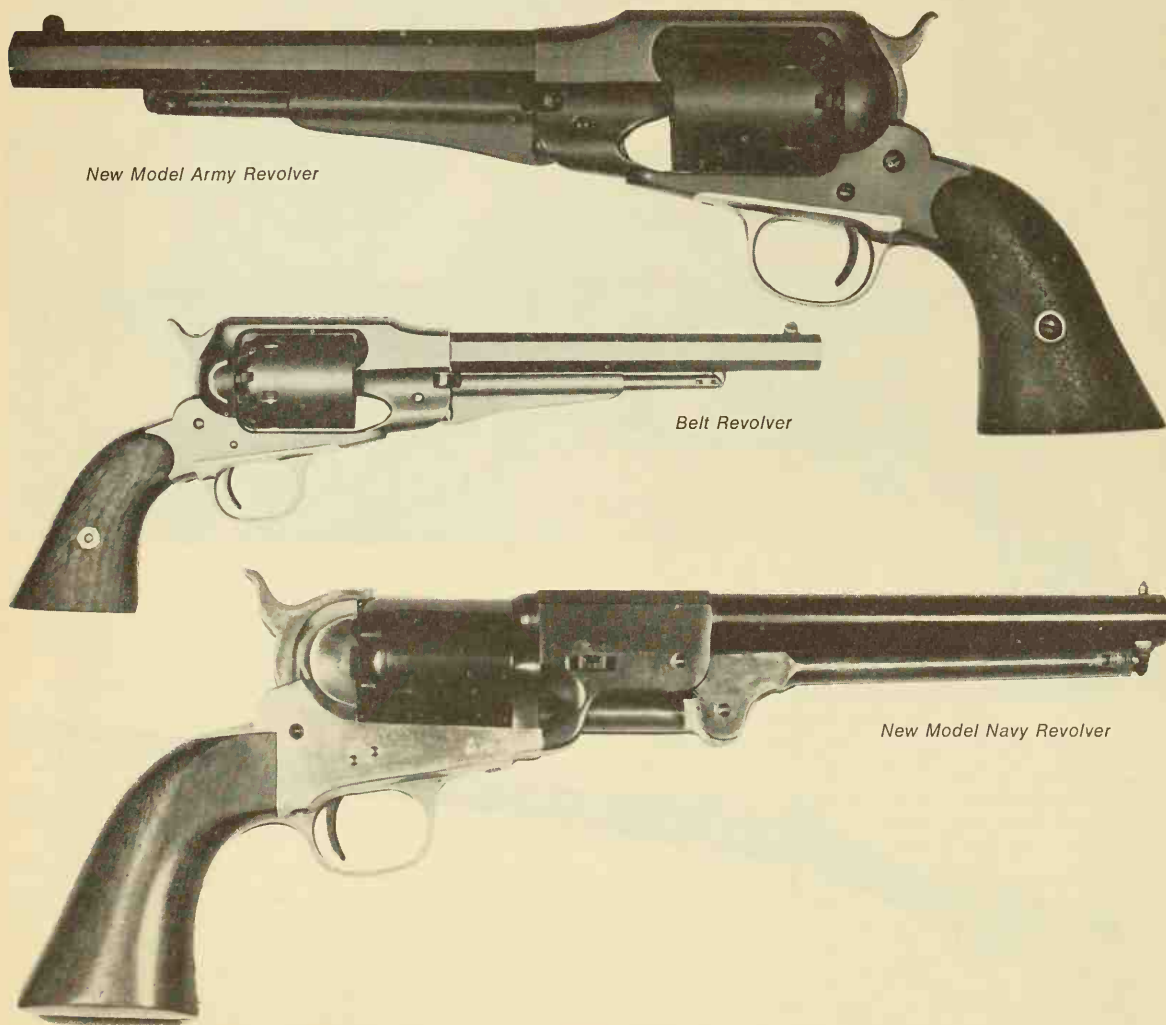
Today, the Navy Arms' line contains several revolver models, a revolving carbine, rifled muskets and carbines, and numerous accessories for the muzzle-loading shooter.

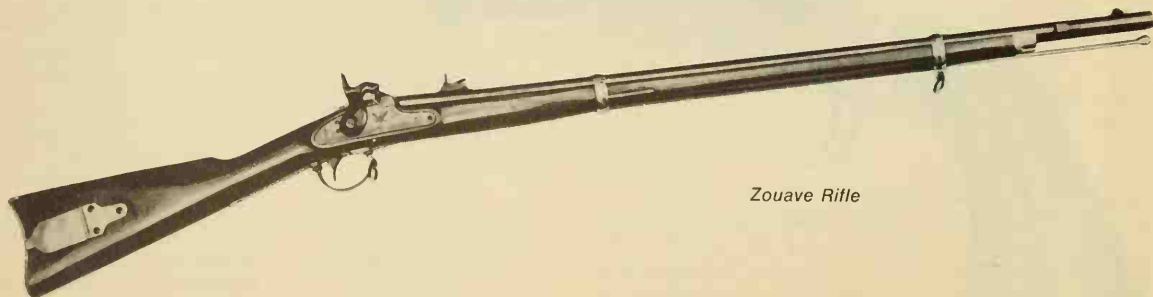
NEW MODEL ARMY REVOLVER: A repro-

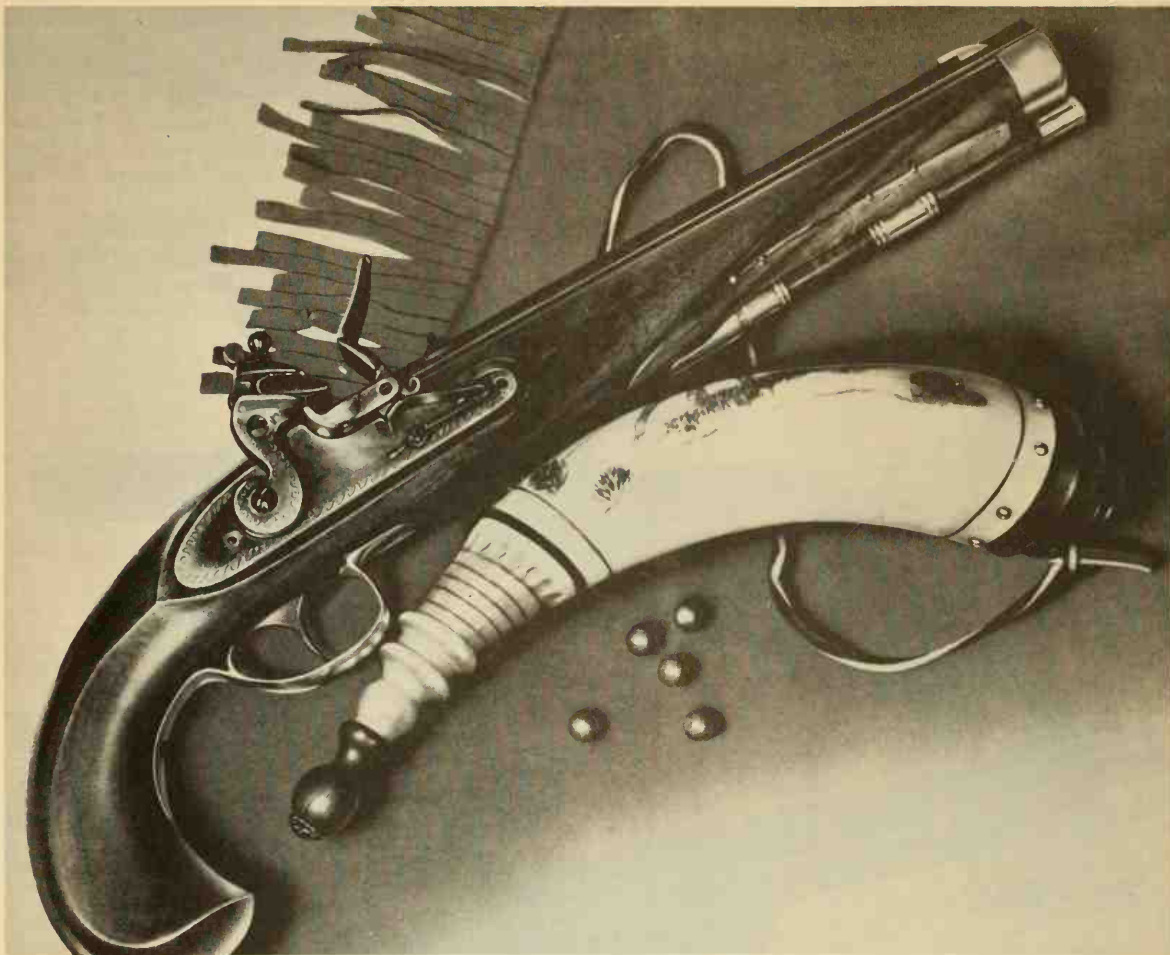
duction of the .44 caliber Remington percussion revolver of the same name. We've used several examples of this model over the years and find it the simplest and most convenient to shoot of those offered today. Blued finish, polished brass trigger guard, two-piece smooth walnut grips.

BELT REVOLVER: A .36 caliber version of the above gun, shortened and lightened somewhat. Quite popular among serious shooters because of its lighter recoil.

NEW MODEL NAVY REVOLVER: A line for line copy of the well-known Colt 1851 .36 Navy Revolver which enjoyed such great popularity during the period of the Civil War. Frame, hammer, and rammer case hardened in color, barrel and cylinder blued, trigger guard polished brass. One-piece walnut grips.

*New Model Army Revolver**Belt Revolver**New Model Navy Revolver*

*Sheriff's Model**Presentation Grades**Zouave Rifle*



Kentucky Pistol

SHERIFF'S MODEL: Identical to the New Model Navy but with shorter, 4" barrel-rammer shortened to match, .36 caliber.

The above three guns are also available in presentation grades with hand engraving and precious metal inlays.

KENTUCKY PISTOL: A nicely finished .44 caliber flintlock pistol of classic "Kentucky" style. Octagonal barrel, walnut stock, brass furniture, lock is case hardened in colors, barrel blued. Measures 15½" in overall length.

REVOLVING CARBINE: This is the basic mechanism of the New Model .44 Army revolver fitted with a 16" or 18" barrel and the frame altered to permit permanent attachment of a walnut carbine-type stock.

Brass buttplate, six-shot, .44 caliber. (I killed a wild boar with one of these a few years ago.)

ZOUAVE RIFLE: A copy of the Remington-produced version of the U.S. M1863 .58 caliber rifled musket of the Civil War. Walnut stock; steel ramrod; brass bands, nose cap, buttplate and patch box. Lock plate color hardened, barrel and guard blued. Elevating musket rear sight, blade front. Detachable hooded cross-wire "sniper" front sight available at extra cost. Uses standard .58 caliber Minie bullets and up to 60 grains black powder. Authorized by the North-South Skirmish Association for rifled musket competition.

ZOUAVE CARBINE: Identical to Zouave rifle above, but with 22" barrel and carbine-style stock. Makes a good hunting gun.

REPLICA ARMS

REPLICA ARMS: Another company formed a few years ago for the purpose of foreign manufacture of replica percussion revolvers for sale in this country. Under the guidance of Mr. Phelps, this firm has kept its quality consistently high. The line is manufactured

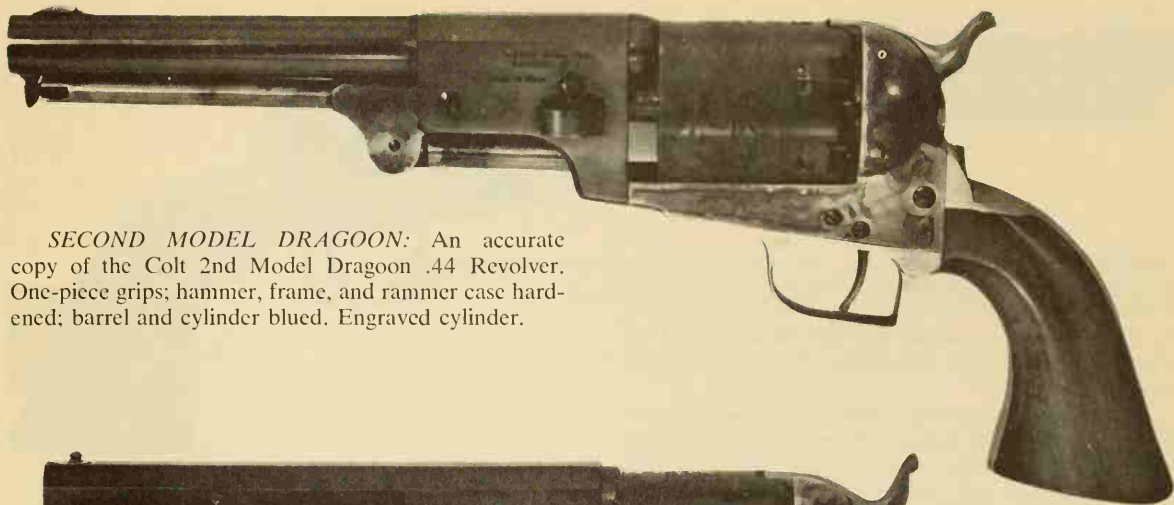
in Italy and consists principally of accurate copies of most Colt models from the 1836 Paterson up through the 1861 .36 Navy or Police Model.

We've shot most of the Replica Arms models and find them to be both reliable and accurate. Even the folding-trigger Paterson Colts shoot well. Fit and finish are uniformly quite good. Various accessories are also offered.

TEXAS PATERSON: Excellent copy of the original Colt in .36 caliber, highly polished and nicely blued, hammer and frame case hardened in colors. Crisp, clean action. Takes No. 10 or No. 11 caps. Five shots. Furnished with 6", 7½", or 9" barrel.



WALKER .44: Fine copy of the famous Walker Colt of 1847. Oval cylinder stops; weight, 4¾ lbs.; 15¾" overall with 9" barrel; one-piece grips; brass guard, blued barrel and cylinder, case hardened hammer, rammer and frame. A nice piece that will take up to 60 grains of FFG Powder with a .452" round ball. Uses Size 13 caps. Engraved cylinder.



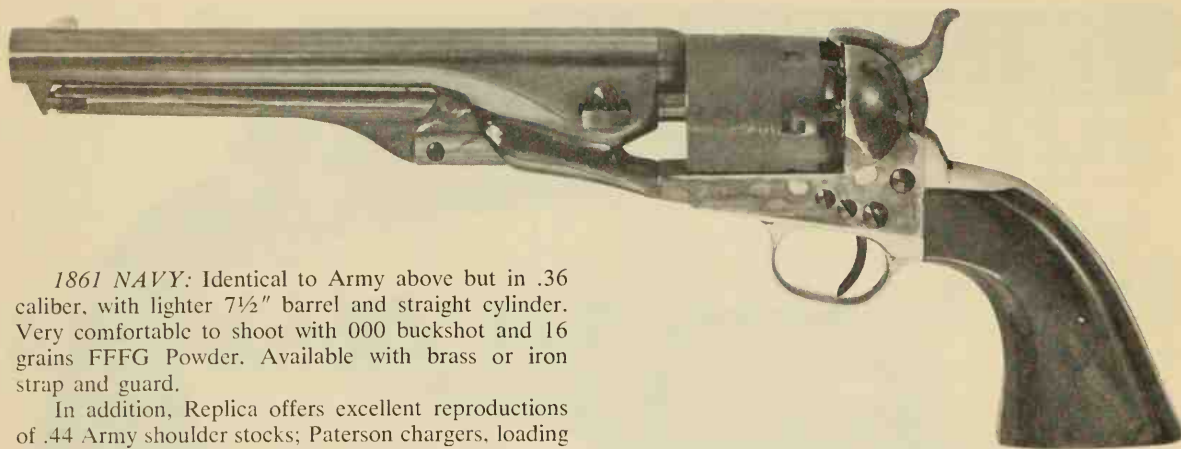
SECOND MODEL DRAGOON: An accurate copy of the Colt 2nd Model Dragoon .44 Revolver. One-piece grips; hammer, frame, and rammer case hardened; barrel and cylinder blued. Engraved cylinder.



BABY DRAGOON/WELLS FARGO: Copy of the .31 caliber Colt M1848. A 6" barrel, 10 $\frac{3}{8}$ " overall, weight, 25 ozs. Hammer, frame, and rammer case hardened in colors: polished brass guard and backstrap, rest blued. One-piece walnut grips. Octagon Barrel, 5-shot, takes Size 9 or 10 caps. Available in 4", 5", 6" barrel with rammer as Baby Dragoon, 3", 4", 5", 6" without rammer as Wells Fargo. Engraved cylinder.



1860 ARMY: Excellent copy of the original .44 caliber Colt Army revolver. An 8" barrel, 13 $\frac{5}{8}$ " overall, weight, 38 ozs. Six-shot, uses .452 to .454" round balls, Size 9 or 10 caps. Frame, hammer, and rammer case hardened in color. Polished brass guard, one-piece grips; barrel, cylinder and backstrap blued. Engraved cylinder. Cut for shoulder stock.



1861 NAVY: Identical to Army above but in .36 caliber, with lighter 7½" barrel and straight cylinder. Very comfortable to shoot with 000 buckshot and 16 grains FFFG Powder. Available with brass or iron strap and guard.

In addition, Replica offers excellent reproductions of .44 Army shoulder stocks; Paterson chargers, loading levers and accessories; molds, nipple wrenches; and soft or hardwood and leather cases patterned after the original Colt items. All are of excellent quality.



Paterson Charger

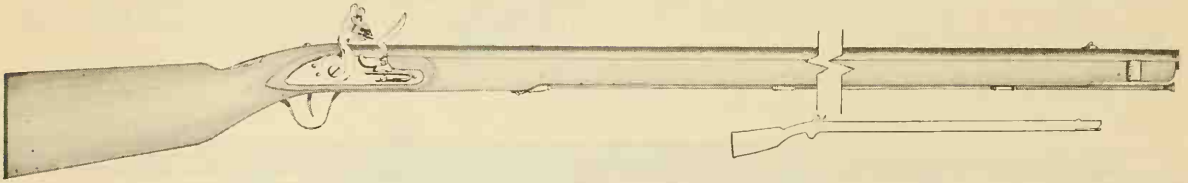


Adjustable Powder Flask

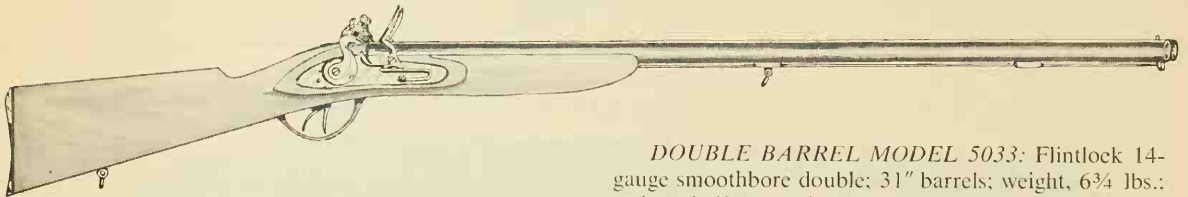
STOEGER ARMS CORP.

STOEGER ARMS CORP.: An old-line firm that has been importing all manner of guns, ammunition, accessories, and related items for many years. Back

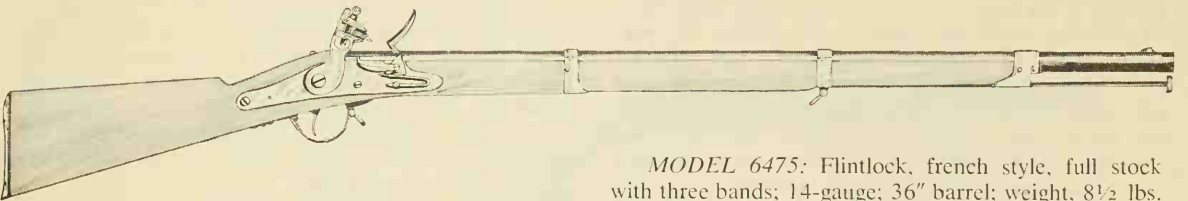
before the words "replica" and "reproduction" became common and before today's wide variety of muzzle-loading guns became available, Stoeger offered so-called "Trade Guns." These guns are still available today for decorative purposes only and are as described below.



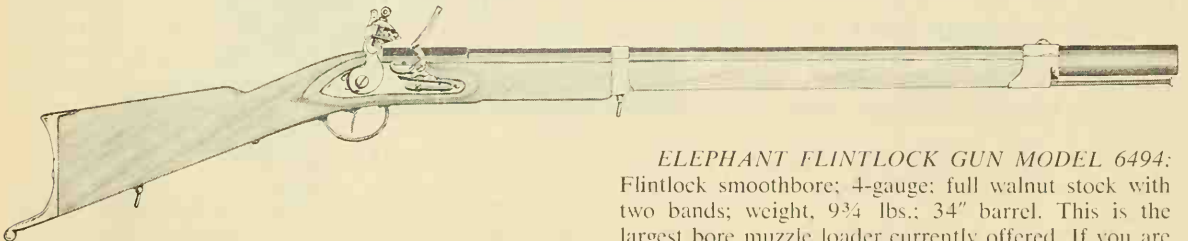
BUCCANEER MODEL 4910: Flintlock; smooth-bore; 12-gauge; 51" barrel; weight, 9¼ lbs. New barrel and stock assembled with European military lock. Stock is full length and painted red, with brass furniture. Variations to be expected.



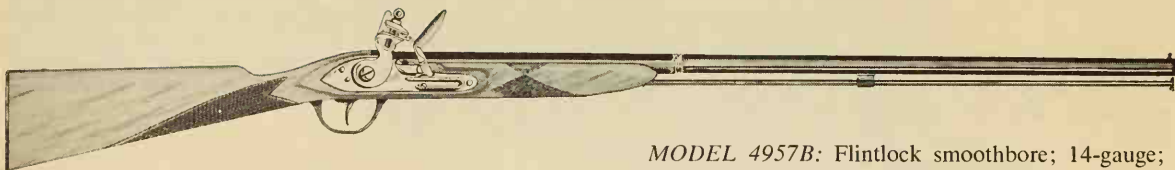
DOUBLE BARREL MODEL 5033: Flintlock 14-gauge smoothbore double; 31" barrels; weight, 6¾ lbs.; walnut half-stock; iron ramrod. Variations to be expected.



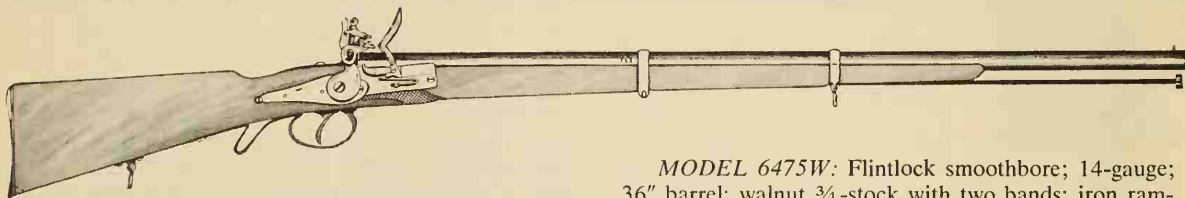
MODEL 6475: Flintlock, french style, full stock with three bands; 14-gauge; 36" barrel; weight, 8½ lbs. Variations to be expected.



ELEPHANT FLINTLOCK GUN MODEL 6494: Flintlock smoothbore; 4-gauge; full walnut stock with two bands; weight, 9¾ lbs.; 34" barrel. This is the largest bore muzzle loader currently offered. If you are partial to tossing big bullets around, the 4-ounce ball from this cannon will certainly oblige you. Variations to be expected.



MODEL 4957B: Flintlock smoothbore; 14-gauge; 33" barrel; weight, 6 lbs.; checked walnut half stock; iron furniture and steel buttplate. A nice light-weight gun. Variations to be expected.



MODEL 6475W: Flintlock smoothbore; 14-gauge; 36" barrel; walnut $\frac{3}{4}$ -stock with two bands; iron ramrod; weight, 7 lbs. Variations to be expected.

DIXIE GUN WORKS

DIXIE GUN WORKS: This firm was originally organized by Turner Kirkland in Union City, Tennessee, to function as a supply house of generally hard-to-get items for the muzzle-loading fan. From a modest beginning, it has progressed to the point where items from all over the world are gathered and offered for sale. Many items are produced specifically for Kirkland abroad. Among these are scores of different lock and gun parts duplicating those originally used. DGW is also the principal supplier of kits from which one may assemble several different complete muzzle-loading guns. The current Dixie catalog contains over 200 pages and represents the widest selection of muzzle-loading gear and parts available anywhere.

Here is a list of selected items from the Dixie Catalog:

DIXIE SQUIRREL RIFLE: New manufacture in traditional caplock style. In .40 caliber, 40" barrel, 6 grooves, 1-48 twist; brass furniture and patch box; lock case hardened in colors; maple stock; weight, 10 lbs.

DIXIE KENTUCKY FLINTLOCK: Virtually identical to the Squirrel Rifle above, but flintlock percussion.

DIXIE DELUXE PENNSYLVANIA RIFLE: In both flint and percussion lock, these guns use the same metal parts as the Squirrel Rifle. The stock is Pennsylvania style and fitted with large, ornate brass patch box.

DIXIE HALFSTOCK TARGET RIFLE: A modern percussion rifle with 32" .40 caliber barrel. Half-stock, shotgun style butt, checkered grip and fore-end; steel furniture; weight, 7½ lbs.

DIXIE BUFFALO HUNTER: Percussion. A short-barreled hunting rifle built around the reproduction .58 caliber Zouave rifle described elsewhere. Half-stock with brass furniture; 22" barrel; lock color hardened, rest of metal blued.

DIXIE DUELING PISTOL: Percussion; 10" smoothbore barrel varying from .44 to .50 caliber; maple stock, checked grip.

DIXIE .36 TARGET PISTOL: Quite similar to the Dueling pistol, but with .36 caliber rifled barrel 11" long, $\frac{3}{4}$ " across the flats.

DIXIE PERCUSSION DERRINGER: A .41 caliber; one-piece cast brass frame and barrel; center-hung hammer; smoothbore; smooth polished grips.

DIXIE RIFLE KIT: Complete kit for assembling a rifle identical to the Squirrel Rifle. In percussion or flint.

DIXIE DELUXE RIFLE KIT: As above for the Deluxe Rifle.

DIXIE PERCUSSION PISTOL KIT: Complete kit for assembling a .40 caliber, 9" barrel Kentucky style pistol.

NUMEROUS OTHER KITS ARE AVAILABLE.



Dixie Kentucky Flintlock



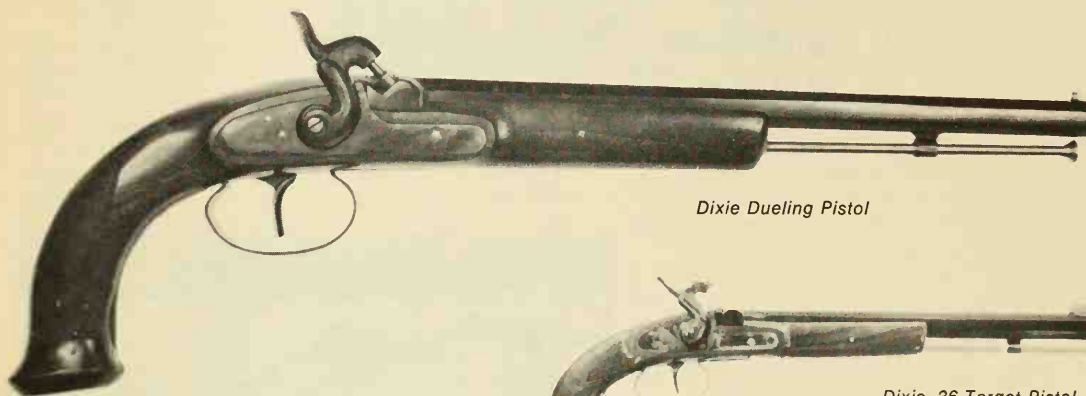
Dixie Deluxe Pennsylvania Rifle



Dixie Hallstock Target Rifle



Dixie Buffalo Hunter



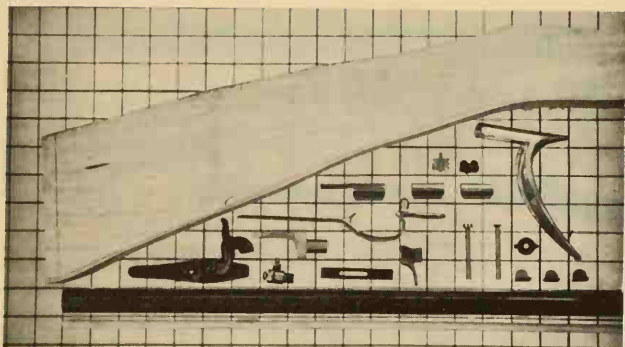
Dixie Dueling Pistol



Dixie .36 Target Pistol

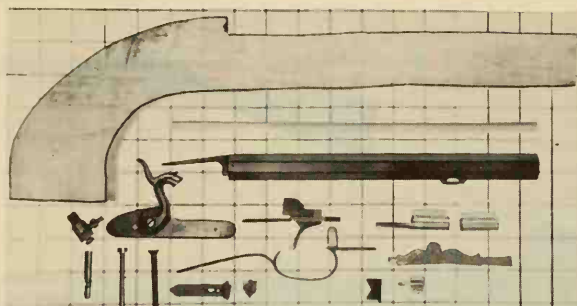


Dixie Percussion Derringer

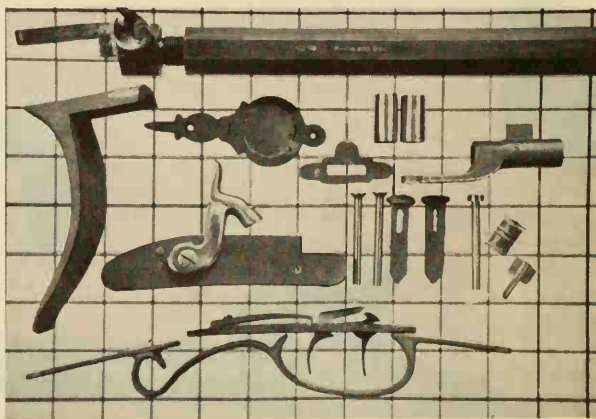


Dixie Rifle Kit

Photos courtesy of Dixie Gun Works



Dixie Percussion Pistol Kit



Numerous other kits that are available.



Chapter 3

LOCK TYPES AND IGNITION SYSTEMS

As becomes repeatedly apparent in this dissertation, the caplock gun is by far the most popular of all front-loaders among shooters today. That certainly doesn't mean that good work can't be done with the earlier ignition systems, or that there aren't many people who use them even today.

A review of the several ignition methods is probably in order, along with fairly solid coverage of the various lock types.

The first "gonnes" were muzzle loaders, and the first muzzle loaders were fired by simply shoving a lighted slow match, hot coal, or red hot wire into a powder-filled flash hole (vent) communicating directly with the propelling powder charge. This type is called "Cannon Lock". Probably the earliest surviving example is the "Tannenburger Buchse." It is known to date *before* 1399, since it was excavated from the ruins of a German robber baron's fortress that was completely razed in that year. The Tannenburger Buchse is a simple, tapered iron tube, formed at the breech end into a socket to accept a pike-pole "stock" which was held under the shooter's arm. It was fired in this position by directing it with one hand while the other applied a slow match to powder exposed in the vent. Guns of this type are also called "Hand Cannon," and sometimes "Petronel." One contemporary illustration shows this type resting in a fork attached to a cavalrman's saddlehorn.



Cannon Lock, without pike-like stock pole, as typified by the Tannenburger Buchse.

The cannon lock could hardly be considered a reliable means of ignition, but we must admit it possessed the virtue of simplicity and, after all, everything must start somewhere.

It might seem that today's shooters would have no interest at all in the cannon lock, but that's not quite

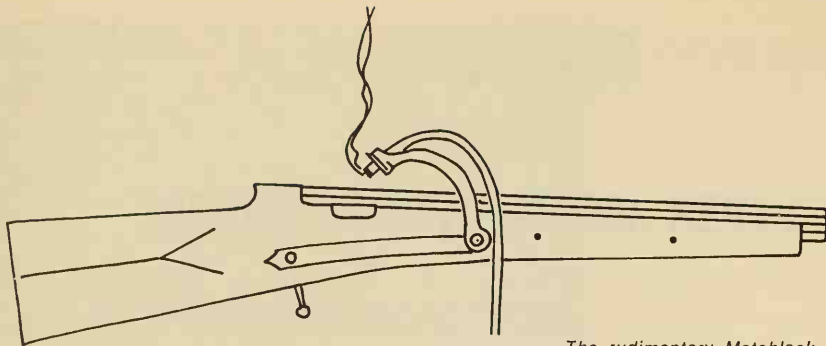
true. We have a small but avid group that prefers to shoot muzzle loading cannons. Most of their guns use cannon lock ignition, though somewhat varied by using a fuse inserted beforehand into the vent instead of applying the flame by hand. Then, too, reproduction hand cannons have been known to show up for firing on black powder ranges.

Following the cannon lock, we find the "Matchlock," a vast improvement. Matchlock guns were fitted with a pivoted, C-shaped metal arm which carried the smoldering slow match. In the earliest form, this match-arm could be moved by one's finger to bring the burning match into contact with powder in a small "flash pan" next the vent. For the first time, both hands could be used to aim and fire the gun simultaneously. Since the gunner didn't have to watch the match to insure it reached the powder, he could keep his eyes on the target and aim, after a fashion.

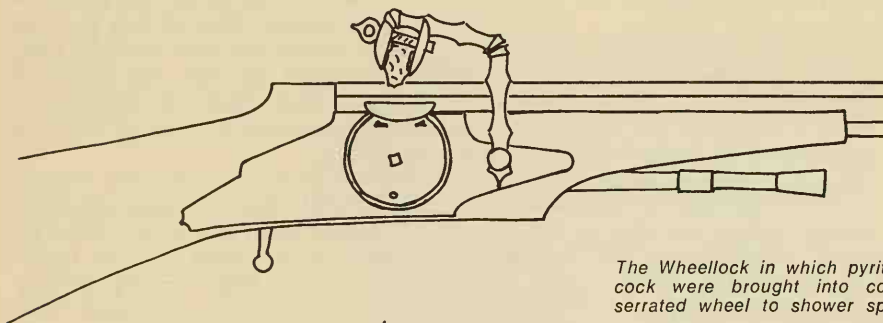
The first positive record of the matchlock appears in CODEX 3069 at Vienna and is authenticated for the year 1411. By 1471, the mechanism had been greatly improved. The match arm became S-shaped and was called the "Serpentine." It was moved to contact the powder by a spring or linkage when a rudimentary trigger was pressed. This marks the first use of the finger-actuated trigger to bring about ignition. As in the earlier form, the match moved toward the shooter's eye which doubtless did little for his peace of mind. It's likely many arquebusiers' eyes were closed at the instant of firing.

In 1475, there was published a description of a vastly-improved lock in which the match moved *away* from the eye to contact the powder. It also contained a lock plate, springs, levers, and the first "sear." Thus, really began the true "lock" we use today. Incidentally, matchlock, revolver-type repeating arms were made in Germany at about this time.

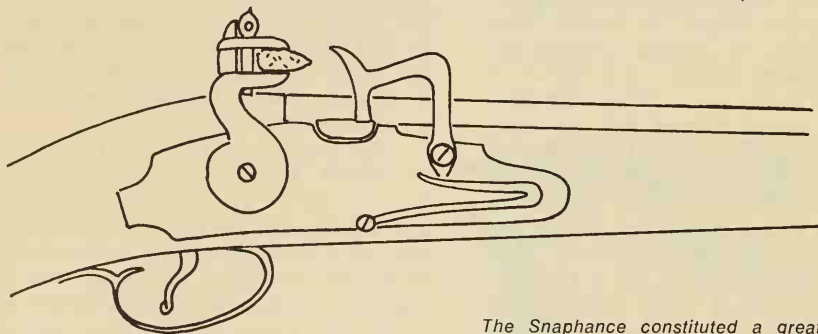
The matchlock continued to be made in numerous variations until the coming of the "Wheellock." Johann Kiefuss generally receives credit for the wheellock's invention at either Vienna or Nuremberg in 1517. This system derives its name from a roughened metal wheel



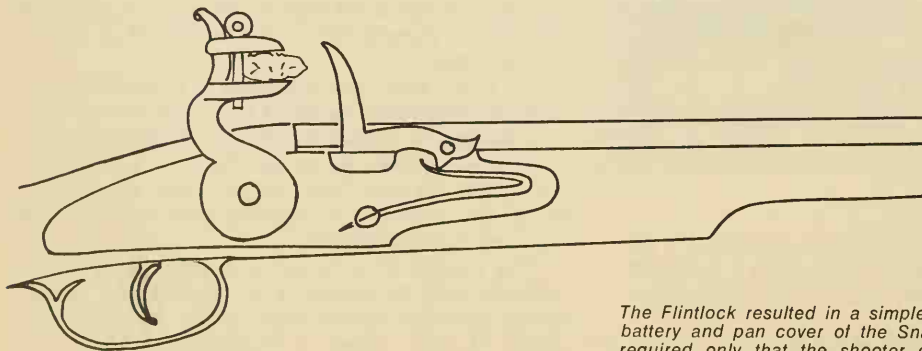
The rudimentary Matchlock in which a "tricker" moved the burning end of the slow-match toward the shooter to ignite priming powder in the flash pan.



The Wheellock in which pyrites in the jaws of the movable cock were brought into contact with a rapidly-spinning serrated wheel to shower sparks into the priming powder.



The Snaphance constituted a greater advance than even the Wheel Lock and greatly reduced the number of motions the shooter must make in order to get a shot off.



The Flintlock resulted in a simple combining of the separate battery and pan cover of the Snaphance. Firing a shot now required only that the shooter cock the hammer and pull the trigger.

spun rapidly against a piece of flint or iron pyrites to throw a shower of sparks into a pan containing fine priming powder.

The pyrites (most commonly used) were held in the jaws of a "cock" resembling today's familiar flintlock hammer. The cock was spring-detented in two positions—clear of the wheel, and down against it. To fire, one first "spanned" the wheel with a wrench or "spanner" provided for the purpose. As the wheel was thus rotated, a chain was wound upon its shaft, tensioning a heavy leaf spring. A sear engaged the wheel to hold it in this position. The cock was then lowered, placing the pyrites in contact with the wheel's grooved rim. Pulling the trigger released the wheel which was spun violently against the pyrites throwing off a shower of sparks which ignited the powder.

Incidentally, the wheellock, to be safe from accidental discharge, characteristically had a very heavy trigger pull. This led to the development of the "set" trigger whose weight of pull was not related to the load placed on the sear.

Compared to its predecessor, the wheellock was quite reliable, particularly in bad weather, and the arquebusier was not clearly shown at night to the enemy by a glowing match. However, its manufacture required much greater skill and better materials—and it cost many times more than a matchlock.

Following on the heels of the wheellock came the "Snapping (Snap) Lock," or "Snaphance." Here, the pivoted cock was spring-powered and carried in its jaws a flint which was struck downward across a rough, hardened "steel" or anvil to throw sparks into the priming powder.

The snaphance seems to have appeared around 1525 and was in fairly wide use by 1550 in various European and Scandinavian countries. No one individual or country can positively be credited with its invention. Pick the story you like and stick with it—it will be hard for someone to *prove* you're wrong.

While internal variations were many, the snaphance principle consisted of the powered cock, movable spring-loaded anvil, and *separate* manually operated flash pan cover. It was cheaper and more reliable than the wheellock, thus, far more suited to military use. Where sporting wheellocks could be afforded only by the wealthy, those of more modest means could aspire to snaphance ownership.

The true "Flintlock" evolved from the snaphance as really a single improvement. The pan cover was combined with the steel, into what is called the "Batterie" or "Frizzen" (also once known as the "Hammer"). This formed an efficient cover for the flash pan which automatically opened as the cock struck, exposing the priming to a shower of sparks. As the flint struck the curved face of the frizzen, it cammed that surface up and forward, carrying with it the integral, right-angle pan cover. Coincidentally, this *upward* movement of

the frizzen as the flint moved *downward* increased the relative velocity of the two, improving the shower of sparks.

Where the snaphance pan cover had to be opened at least several seconds before the flint struck, the flintlock priming powder was exposed to the elements only as the instant sparks were already flying toward it. The advantage in rain, snow, and wind is obvious. Improvements such as fences and drain grooves made the flintlock more reliable than its predecessors in rain, but it was never truly waterproof.

The name "Flintlock" appeared first in "Pallas Armata" in 1683, but the actual origin of the type is shrouded somewhat in the mists of history. The flintlock's salient features are known to have been combined in a single mechanism and used in France before 1615. One specimen exists by a maker, Jean C. Bourgeois, who died in that year.

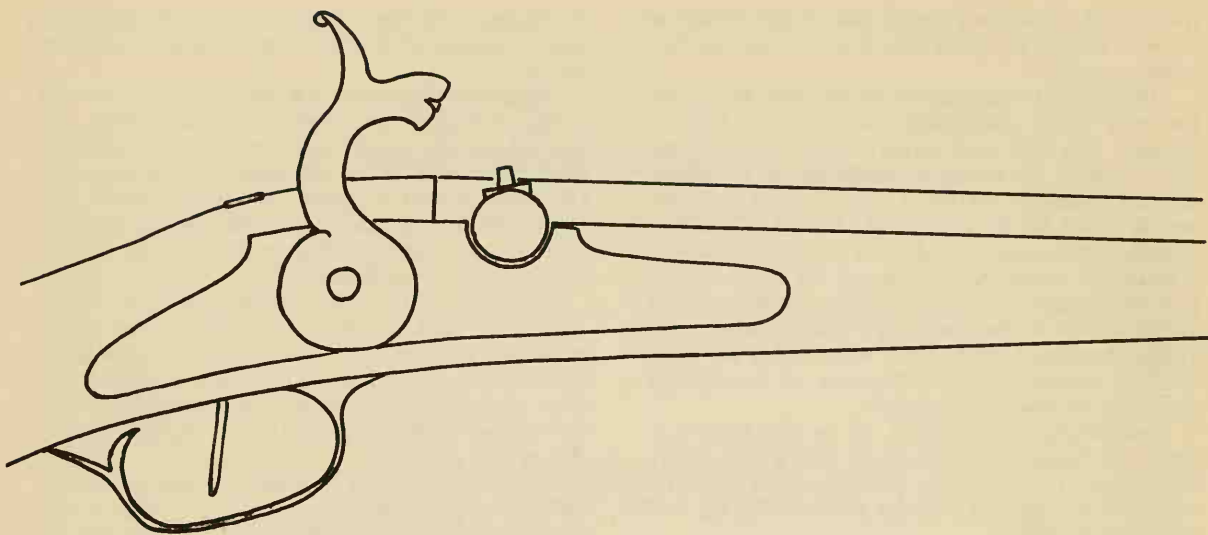
The flintlock caught on slowly and did not become widely distributed until after 1640. In 1690, it was officially adopted by the British Army, long after its acceptance by the French.

As further detailed, development stagnated with the flintlock. For example, the British used it with little variation from 1690 until 1840. France's Army used a single basic model flintlock Charleville musket until 1842. For very nearly a full century no improvement took place.

The earliest days in America show little record of the firearms used. In 1628, the Massachusetts Bay Company was known to have imported snaphances for use by its mercenary troops. Wheellock fragments and spanners have been unearthed at some colonial sites. Considering the circumstances under which the first colonists arrived on these shores, it seems likely the bulk of their arms would have been the cheap, though obsolete, matchlock. The few wealthy administrators and adventurers were probably carrying wheellocks, but these expensive and complicated arms would have been beyond the average colonist's means.

Arms making per se, as opposed to repair and overhaul, in America no doubt began with flintlock arms of German gunsmiths settled in Pennsylvania. Their products eventually evolved into the flintlock "Kentucky" rifle and descended directly from the heavy Swiss and German "Jaeger" rifles.

The ultimate in muzzleloading arms ignition was achieved in the Percussion Lock. It represented little mechanical change, but rather an adaptation of the existing flintlock to the use of the percussion cap which is covered in detail further on. The cap made it possible to do away with the heavy double-jawed cock and flint. Also, the flash pan and frizzen. Their places were taken by a simple one-piece hammer, nipple, and bolster screwed directly into the gun barrel. Internally, the flintlock mechanism needed no change—and none took place, other than evolutionary simplification.



In the greatly simplified percussion lock the, muzzle-loading arm achieved its most perfect and efficient ignition form. For the first time, the ignition system could be truly waterproof and far more sure-fire than ever before.

Freed from the encumbrance of flash pan and frizzen, the percussion lock developed into smaller and more pleasing forms. The familiar lock configuration with its mainspring ahead of the hammer predominated and became known simply as the "Side Lock." The "Back-Action Lock" was developed with the mainspring behind the hammer. This eliminated need for extensive weakening of the stock forward of the hammer. The back-action lock was inletted into the wrist of the stock, permitting a more graceful overall stock shape.

The Box Lock also became more prominent in percussion form, though it existed earlier in flintlock form. The hammer was placed *inside* the lock plate, thus, rendering it less likely to snag on brush or one's clothing and equipment. It was often used on small pistols of pocket or muff type where the hammer was situated on the center line of the bore.

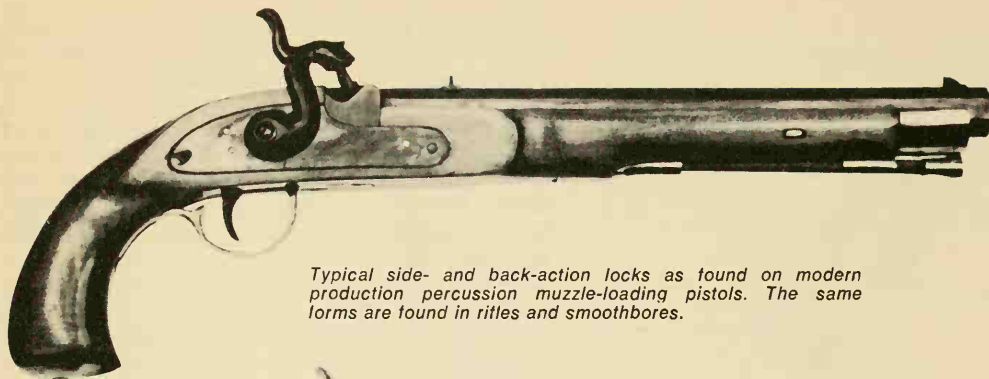
The percussion cap made possible the "Under-striker" or "Under-hammer" lock—something not possible so long as loose priming powder was used. Simplicity and low cost were major virtues of the under-striker. The percussion nipple was placed on the underside of the barrel and a conventional but upward-striking hammer hung to its rear. In the simplest form only two other parts were required—the mainspring which did double duty as the trigger guard, and a trigger. There was (is) no complicated and costly arrangement of sear, tumbler, stirrup, lock plate, etc. It possesses other virtues as well: cap fragments are directed away from the shooter's face; nipple and cap were protected somewhat from rain and snow by being

beneath the barrel; nothing protrudes upward to interfere with sighting.

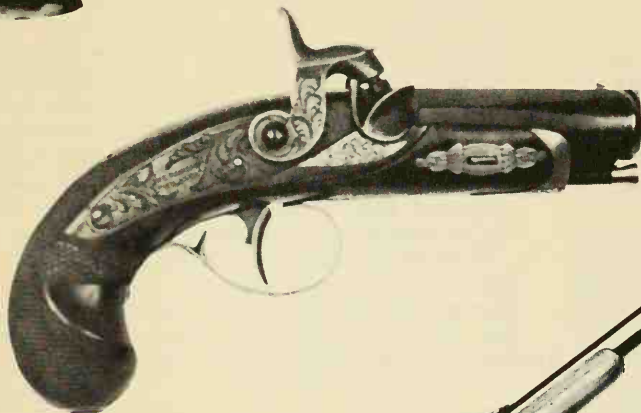
It is interesting that an under-striker caplock muzzle-loading rifle is produced in quantity today—the Hopkins & Allen, by Numrich Arms—for the same reasons the design was originally developed. This gun is available in several models as this is written, priced as low as \$75. Many modern-day percussion target rifles are built around under-striker locks that have been highly refined to produce minimum lock time and maximum uniformity of ignition.

Also an off-beat product of the practical percussion cap was the "Mule-Ear" lock. This type has the nipple horizontally on the *side* of the barrel. The hammer is a simple lever or bar that swings horizontally to strike and detonate the cap. The mule-ear possesses most of the advantages of the under-striker, except that it is neither cheap nor simple. If anything, it is more complicated than a conventional side lock. It does have the virtue of the hammer(s) lying very close to the barrel(s), thus, making for a very compact and streamlined arm.

For all practical purposes percussion lock development ceased with the introduction of breech-loading arms. In recent years, however, black powder target shooters (primarily) have sought more uniform ignition in muzzle loaders. Since the modern centerfire primer is far more uniform and reliable than the percussion cap, attempts have been made to utilize it in place of the latter. The result is called the "Primer Lock," for want of a better name.



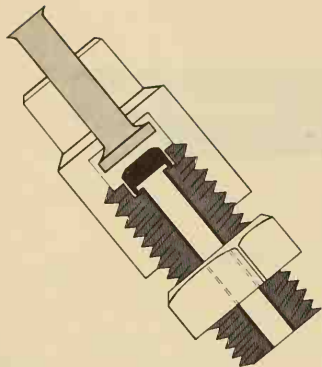
Typical side- and back-action locks as found on modern production percussion muzzle-loading pistols. The same forms are found in rifles and smoothbores.



Modern Hopkins & Allen Understriker rifle which is identical to the basic lock form used during the true percussion period.



The Box Lock, with most of the hammer enclosed, became popular for small concealable pistols such as this brass-barrel, spur-trigger derringer.



In the Primer Lock, the nipple is replaced by the device above. A primer is placed in the shallow recess, then the cap containing the striker or firing pin is screwed over it snugly. A typical percussion hammer then strikes the firing pin to explode the primer. Some designs use a swinging or hinged piece carrying the firing pin rather than the threaded cap shown.

Primer locks are almost invariably custom-made by the shooter or his gunsmith and they take several forms. The most basic is a modification of a conventional caplock. The nipple or nipple and bolster is replaced by a block containing a recess for a standard pistol primer. On top of the primer is screwed a closing block containing a short firing pin. The original hammer may be altered slightly to strike the firing pin to detonate the primer. This type retains several disadvantages of the original caplock—long, slow hammer fall and a right-angle turn the primer flash must traverse—so is not particularly common or popular.

The under-striker form seems most common with mule ear and center-hung box lock following in that order. All three utilize a single, straight vent leading directly from the primer to the propelling charge.

A boss or bolster is secured to the barrel, counter-bored and threaded for a housing containing the primer and firing pin. Since this housing must be removed to replace the fired primer, interrupted threads, and even handles may be used. Some are constructed so that the primer may be pre-crushed—seated under a specified, uniform load—to increase its sensitivity.

Hammers and internal lockwork are almost invariably designed to function in the least possible time—producing minimum lock time. This allows less chance of throwing a shot off in that fraction of a second after the sear releases but before the bullet departs the muzzle. Such units are invariably custom-built to widely varying designs and may be seen at almost any major muzzle loading bench-rest match.

Though the primer lock is a far cry from the traditional percussion lock, it has evolved directly from the latter to meet a specific need. As such, we certainly can't ignore it.

Several other modern percussion lock types exist and deserve some mention. They are conversions of early breech loaders, backward in time, to furnish cheap muzzleloaders for fun shooting.

One such conversion is carried out on large-caliber Remington Rolling Block rifles. The firing pin is removed from the breech block which is then fitted with either a conventional nipple or some form of primer-lock. The hammer face is then altered to suit either cap or primer.

With this accomplished, a decapped fired cartridge case fitting the original chamber is seated and the breech block closed. The gun may be fired as a percussion muzzle loader at this point, though some shooters prefer to pin or otherwise secure the breech block permanently in the closed position to prevent inadvertent removal of the cartridge case. This case is essential to the conversion because it provides proper obturation. Cleaning is simplified if an easily (but not accidentally) removable split pin is used to secure the breech block shut. The action may then be opened to allow cleaning from the breech; and also to draw the charge when that becomes necessary or desirable.

With all this rambling discussion of lock types and ignition systems, you may wonder just how many of them are actually used by black powder buffs today. Well, I'd say all of them are with the possible exception of the wheellock. And, it is left out primarily because originals are too scarce and valuable. And, new ones are too costly and difficult to make. I know of only one man who has shot a wheellock and he did it in order to write a story about it.

Cannon locks are seen at every artillery shoot. Oriental matchlocks aren't too hard to come by in shooting shape. And, if you can't find an original, one is quite simple to make, especially since Turner Kirkland sells new locks of this type.

Snaphances show up occasionally. But, again, Kirkland will sell you an original lock and a new barrel if you just can't get along without one and are willing to expend time and effort to assemble them into a complete gun.

Flint and percussion arms we see in profusion at every shoot. A wide variety of new guns, complete kits, and both new and original parts are available from several sources.

In short, virtually every basic type of muzzle loader ever made—and that takes us back roughly seven centuries—is still shot for fun by people like you.

Flintlock shooting isn't as popular among black powder buffs today as is the more reliable and convenient percussion ignition system. Even so, lots of people lean toward the flint Kentucky rifle and pistol. In recognition of such taste, we have competitions in which only flintlocks are allowed.

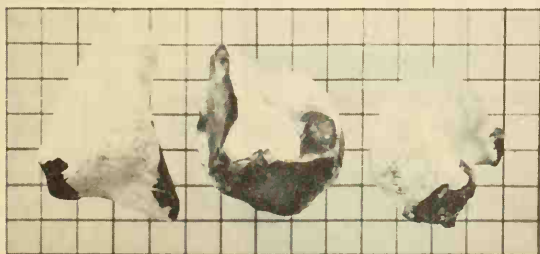
The history of the flint itself—thumbnail-size pieces of stone that for centuries sparked the entire firing

cycle—is more than a little interesting. Wheellock arms didn't use flint. Iron pyrites, as mentioned elsewhere, provided the spark. Being rather friable (easily crumbled), a single piece could last for only relatively few shots at best, and might fall to pieces on the very first.

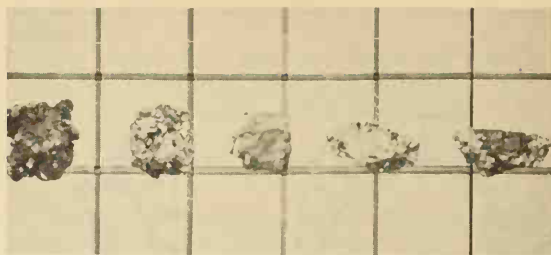
The Snaphance was the first firearms ignition mechanism to use flint as a producer of heat. Since it was invented sometime in the 16th Century, flints (more properly called "gunflints," as pointed out in "Encyclopedia of Firearms") became indispensable to arms users the world over—and remained so for about 250 years. As such, gunflints became an important item of commerce—more so than guns themselves, for in its lifetime a gun might consume thousands of flints. Any one with skill in metals could produce a gun from readily available raw materials, but good supplies of the proper type of flint were rare and there were only a few families and groups with sufficient rare skill in "knapping" the big nodules into usable gunflints. These people were concentrated at the sites of commercially profitable flint deposits and the skill was passed from father to son for many generations.

No one knows just where or how the first flints were produced, but undoubtedly some residual knowledge of stone tool-making figured in shaping the first ones. In fact, the first "flints" may well have been made from chert nodules. Chert is quite similar to flint and occurs in the same form and under much the same conditions. It was often used in lieu of flint for tools in stone-age times.

Flint occurs in irregular, rounded nodules weighing up to 40 lbs. or more. Relatively large deposits existed as float, apparently resulting from the great glacial drifts of northern Europe eons ago. Major sources were found near Brandon, Mindenhall, Savenham, and Tudenham in England and at Yonne, Loire et Cher, and Indre, France.



Small natural flint nodules as they come from the pits. The nodules shown are purposely small, sold as curiosities by Dixie Gun Works. Those from which the knappers shape gunflints weigh 20 pounds or more. Above photo on 1" grid to show size.



Small pieces of Iron Pyrites which were used in wheel locks before gunflints came into being. These pieces would have to be carefully shaped before use.

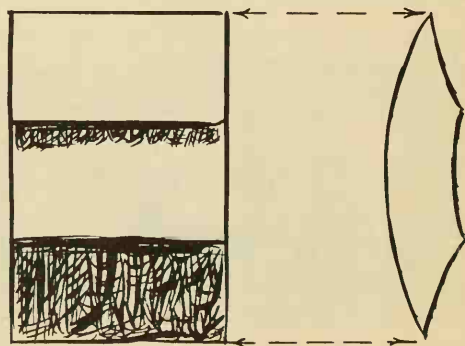
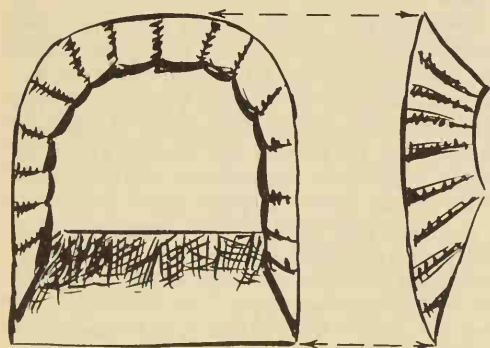
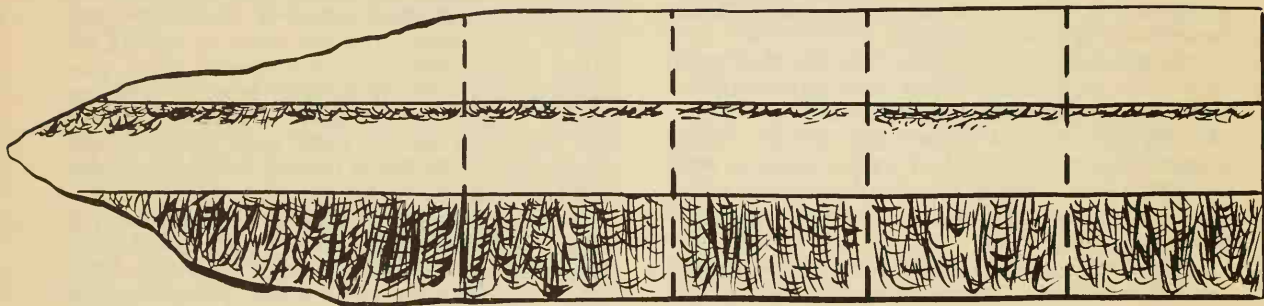
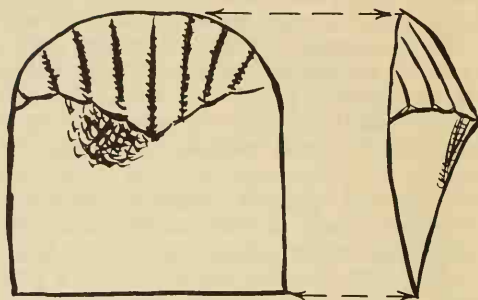
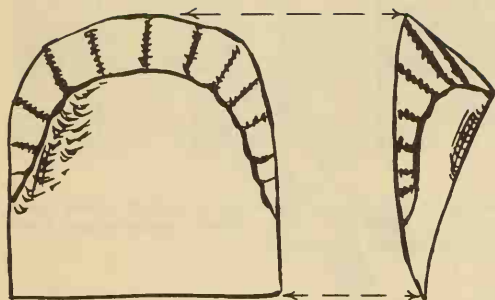
In any event, historians and arms students agree that by 1650 a characteristic form of gunflint had developed and was fairly well standardized. Some prefer to call this form a "gunspall," rather than a gunflint. This for the reason that a single "spall" (chip) was struck from the prepared surface of a relatively small, rounded flint nodule. This was done by striking the surface sharply with a pick-like hammer which concentrated great force (in terms of pounds per square inch) in a small area. A skillful knapper could produce reasonably uniform spalls quite rapidly in this fashion, holding the nodule between his knees with one hand and working round it with his hammer.

This spall came from the nodule in the shape shown, and was then trimmed or "gnawed." Light hammer taps chipped away the excess to produce a usable flint of the desired size. Or, each spall may have been trimmed as quickly as possible without regard to size—leaving sorting and grading to someone whose time was less valuable than the knapper's.

The gnawed heel thus produced is characteristic of later French flints, so it is often assumed that the process developed first in the French flint mines. No documentary evidence exists to back this up, so it may well have happened another way. I can't think of any valid reason to suppose the English, Prussian, or even Russian knappers may not have originated the gnawed heel. In any event, the gnawed flint became known as the "French" type, while the squarish, untrimmed variety became known as the "English" type.

The spall-type flint worked well enough, but took more time than was desirable to produce. In addition, its working edge is thinner and more likely to wear or chip away rapidly than later types.

During the early 18th Century a new method of producing flints was developed. Whether this was the result of deliberate effort or simply an accidental rediscovery of cave-man techniques is hard to say. Neolithic man had mastered the art of striking long, sharp blades (strips) of flint from prepared nodules. From these several-inch long blades, he fashioned knives, lance points, and other piercing and cutting tools.



Top, the "gunspall"; lower left, "gnawed" flint of French type; middle, the flint blade as struck from the nodule, to be broken along dotted lines to produce plain English-type flints as shown at lower right. The added simplicity of the latter type is clearly evident.

The knapper wasn't interested in stone knives, much preferring iron and steel, but rather in those long flint blades of the proper cross-section to make strong, durable gunflints. A properly-struck blade could be broken across at intervals to produce as many as a half-dozen flints in less time than required to trim one or two spalls to shape and size.

By the middle of the 18th Century, this technique had been well developed resulting in the conventional "standard" gunflint forms familiar to us yet today—British and French. The former consisted of the blade segment untrimmed, and either end could be expected to strike a good shower of sparks. With care, it could be reversed in the cock to provide a second striking edge when the first wore out. The French type had one end trimmed and rounded after gunspall fashion. This produced a sturdier, neater flint, but consumed more time.

As the flintlock became universally accepted for both military and sporting use, demand for flints ballooned. Dependable supplies were a must. The common soldier was usually issued flints in the proportion of 1 per 20 rounds of powder and ball—even though contemporary writings state that "a good flint will last for more than fifty fires." "Large," "Medium," and "Small" flint sizes evolved. Muskets took the largest about 1" wide, while the $\frac{3}{4}$ " wide medium size sufficed for shotguns and some rifles. Small flints measured about $\frac{5}{8}$ " wide and fitted most sporting rifles and pistols. Generally, the flint should be as wide as the widest part of the cock jaws.

The British and French areas already mentioned became centers of organized flint mining (from open pits) and knapping.

Actually, both sites are reported to have been operating in a well-organized manner before 1700. Russia is reported to have obtained its flint from Podolia, in Poland, but whether as nodules or finished gunflints is open to conjecture. Other countries possessed of any significant deposits of suitable flint are certain to have developed and exploited them for their own use, but French and British flints became, for all practical purposes, the World's supply. They were shipped in barrels to wherever firearms were in use and were as essential to war (ever a popular pastime in those days, as now) as powder and lead. Reference is often found in the writings of the 18th Century campaigners to shortage or plenty of flints and the effect it had upon their actions. A soldier down to his last flint, even if it be fresh and unused, might well be reluctant to fire his musket.

If that last flint failed, his Brown Bess or Charleville became nothing more than poor club and a worse pike.

In 1789, France is reported to have had over 30,000,000 flints in stock, while Russia was producing at the meager rate of 45,000 per month. France was more active than England in the world flint trade,

supplying that country, as well as, Spain, Holland, the newly freed American States, and other lucrative markets.

It is interesting to note that British and American troops faced each other during our Revolutionary War—both with gnawed-heel, yellow French flints in their musket-cocks. Excavations of battle sites show the French type outnumbering the angular, black British flints 9-to-1.

There is documentary evidence that France dominated the world flint trade through 1800, after which canny British merchants began to get their share. Historians and archeologists have found that in the War of 1812, only half of the flints used by British troops came from France—the rest being the home-grown product. Then, by the close of the flintlock period around 1850, virtually all flints used in the Americas came from the hands of British knappers.

Though the flintlock era may be said to have ended by the middle of the 19th Century, demand for gunflints by no means died out entirely, or even quickly. Military demand by the major powers did cease to exist during the period armies were re-equipped or converted to percussion ignition. But, a smaller flintlock market existed and was exploited extensively. Even today, flintlock arms will be found in use by many primitive tribes. British knappers enjoyed reasonable prosperity until roughly the period of WWI, and then their fortunes declined rapidly.

Today knapping isn't entirely a lost art, but very few practice it. Virtually all the world's supply of natural gunflints comes from a handful of English knappers near Brandon. There they still strike razor-edged blades from blackish flint nodules, then break them into usable flints. They work squatting on the chip-covered ground, resting a nodule on a stake and steadying it between leather-aproned knees while plying the knapper's hammer with precision and regularity.

While some flints are used by atavistic gun buffs on the Continent, the bulk of Brandon's output is shipped to the U.S.A. and Africa, with a sprinkling elsewhere.

The true traditionalist, the fellow who tans and sews his own buckskins and smokes willowbark in his hand-made pipe will insist on natural flints for his present-day shooting. However, if the small supply ever completely disappears, modern technology has provided ready substitutes. In fact, substitute (if we may call them that) flints produce a better, and hotter spark, and will last many times longer than the original. They are saw-cut to precise shape and can be had to fit almost any size and type flintlock.

Les Bodell, of Peoria, Illinois, makes them from Montana Agate which is a very hard, dense stone, somewhat less brittle than flint. Doubtless, there are other materials that would be suitable but Les and his flintlock compadres say Agate is the best they've tried thus far. Shooters have reported a life in excess of 200

fires, with virtually no misfires due to poor sparking. Though ignition time hasn't been checked with sophisticated instruments, many say it "seems faster" than with natural flints.

When properly seated in the cock, an Agate flint simply wears down without significant chipping of the edge. When wear has progressed to the point that not enough sparks are produced, an agate flint may be restored to usefulness by "sharpening" the edge. A fine-grit, wet wheel is used and plenty of cooling water. Otherwise, heat and pressure will crack the agate.

As natural flints become harder to get, it seems logical to use agate for regular shooting, while hoarding a good supply of fine, black, English Brandons for whatever the future might hold, and for "showing off" occasionally.

No doubt some of the ceramic materials produced today would make ideal flint substitutes. It only remains for some black powder buff familiar with these materials to do a little research. I'll wager he can come up with a cheap, easily-produced "flint" for the day when the last Brandon knapper lays down his hammer.

Percussion ignition changed firearms' history and development virtually overnight. Flint ignition had reigned supreme for over 2½ centuries, and gun development had, for all practical purposes, stagnated within the system's considerable limitations.

Then, in the first decade of the 19th Century, (1807) a reasonably safe and reliable percussion ignition system appeared. A few more years, and by the early 1820's the percussion cap had been patented and placed in production. The passage of another score of years saw the percussion cap eclipse the flint entirely. Thus, in less than 40 years, a new system wiped out one which had endured for 250 years. Considering the resistance to change typical of the early 19th Century, this is a most remarkable accomplishment. Actually, that resistance to change, particularly among military minds, prevented the changeover from coming at least a decade earlier.

Today when "percussion" ignition is mentioned, we tend to think only of the small, shiny percussion cap with which we prime our muzzleloaders. However, the cap was preceded by other forms of percussion ignition, and they should at least be examined briefly. In reality, even today's superb metallic cartridges use the percussion ignition system.

By definition, "percussion" (from the Latin "percutere") means to strike smartly or violently. Anything used or caused to function by being struck as drums, cymbals, etc., is a percussion instrument or mechanism. Consequently, any ignition system depending upon a sharp blow to initiate an explosive which then fires the propelling charge belongs in the "percussion ignition" family. The flint system may seem to fit the same definition—but does not. Ignition in that system is produced by sparks struck when the flint *slides* or

skids along a roughened steel surface. There, friction, not percussion, does the work.

Alexander John Forsyth, a Scotsman from Aberdeenshire, was an ardent sportsman frustrated by wildfowling misses he attributed to the inefficiencies of flintlock ignition. A minister of the Gospel, he was also accomplished in chemistry and mechanical arts and skills, a well informed and inquiring person not averse to probing the unknown. He began experiments with highly sensitive fulminates reported upon earlier by one Edward Howard.

He obtained sufficient political support to be allowed by the British Master General of Ordnance, Lord Moira, to conduct secret experiments in the Tower of London. Beginning there in 1806, he had, by 1807, developed a magazine device that placed small quantities of fulminate adjacent to the arm's touch-hole, there to be struck by the hammer to fire the piece. The fulminate magazine resembled the bottles of scent or perfume used by the bathless ladies of the day, to improve their downwind impression. Forsyth's invention is called the "Scent Bottle Lock" for that reason.

Forsyth patented this system of percussion ignition and formed Alexander Forsyth and Company, 10 Piccadilly, London, to produce guns utilizing it for general sale. Though far from perfect, this was the first percussion ignition system of any practical value. Others attempted to copy and improve upon it but were prevented, or at least seriously hindered, by Forsyth patents.

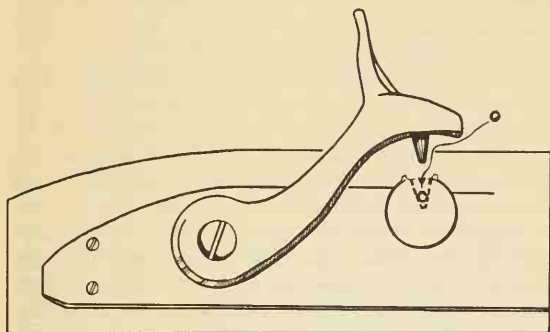
Forsyth's work launched the percussion ignition system. Others saw the Scent-Bottle's shortcomings, and the "Patch Lock" developed. It utilized small quantities of fulminates made into discs or cakes and sealed between layers of waterproof paper. Placed next to the touch hole or over a short perforated nipple and struck by the hammer, these patches gave reliable ignition and were waterproof—an area in which Forsyth's system was grievously deficient.

After the British army switched to percussion ignition some years later, Forsyth was belatedly granted credit for inventing the system, though he and his "rubbish" had been ejected from the Tower by Lord Moira's successor, John Pitt, second Earl of Chatham. In 1839, the House of Commons awarded Forsyth 200 pounds sterling in recognition of his pioneer work that resulted in the development of a reliable percussion ignition system. Later, after his death that same august body, evidently suffering pangs of conscience, awarded an additional 1000 pounds to surviving relatives. As is the usual case, true recognition and appreciation of his accomplishments came all too late to do him any personal good.

The patchlock primer was further developed in metallic form to become the Lawrence disc primer and, when made in a long strip containing multiple spots of fulminate, the Maynard tape primer. Both saw consid-

erable use in the American Civil War. It survives today in the noise-making "caps" used in toy "cap pistols."

Contemporary to the patchlock was the pellet lock, (sometimes called "pill lock"), and the two are much alike. Fulminate was rolled wet into small spherical or egg-shape pellets. They were then coated with wax, varnish, or even foil, to waterproof them. These pellet primers were then placed over the touch hole in a fairly close-fitting depression. The depression might be in a nipple, or simply sunk into the barrel over the chamber. The hammer nose was shaped to crush the pellet in the depression to detonate it.



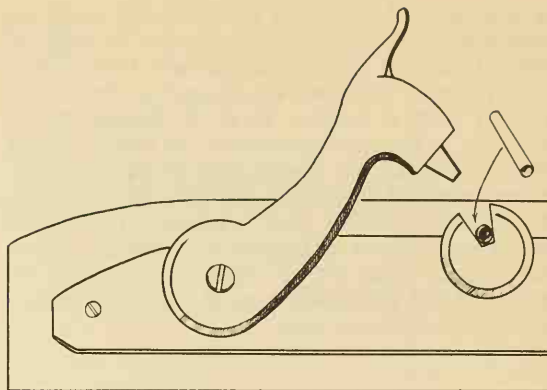
The Pill Lock or Pellet Lock utilized a cone-shape hammer nose to crush a pellet of fulminate that was placed in a recess in barrel or bolster.

The pellet lock made revolving repeating arms practical. The pellet could be stuck firmly in its depression with pitch or wax rubbed over it, yet this did not interfere with its proper functioning. This feature also added to the reliability of any arm in that neither wind, rain, or rough handling was likely to dislodge the primer as often happened with loose or patched fulminate. Significant among pellet locks was the Joseph Manton patent of 1816.

But the pellet-lock was short-lived. Manton next placed the fulminate loosely in a thin, short tube of soft metal (usually pure copper) closed and waterproofed at the ends. Called the "Tube Lock," this primer was laid in a trough or notch over the flash hole. Struck at mid-point by the hammer nose, it detonated, the tube burst, and flame flashed through to ignite the propelling charge. This design gave certain ignition under all conditions. The Manton version (others soon produced similar primers) was approximately 1/16" in diameter and a bit less than 1" in length.

The tube lock was widely used in England and Europe, much more so than the pellet-lock. Neither saw significant use in the United States.

One form of the tube lock utilized an oversized nipple containing a deep recess into which the primer fitted on end. Its upper end was then struck by the hammer.



The Tube Lock was contemporary to the Pill Lock. Though perhaps superior in waterproofness and ease of handling, it was more costly and didn't represent much of an advantage over pills or pellets.

This type had disadvantages—most obvious of which was the fulminate residue and copper fragments which could prevent insertion of a fresh primer after only a single firing.

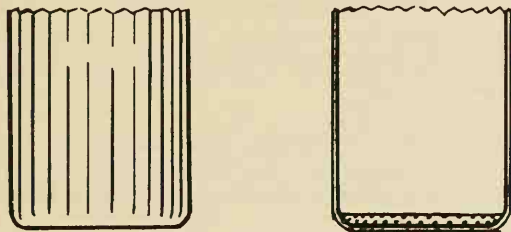
Percussion ignition achieved its most practical form for non-cartridge arms in the form of the percussion cap as we know it today. In 1819, a French patent on this device was issued to one Prelate. In another form, it was patented in France by Deboubert. These patents covered a copper (or other soft metal) cup containing a layer or wafer of fulminate inside its closed end. This cup was inverted and placed over a perforated nipple or cone, confining the fulminate over the flash hole. The walls of the cup were springy, tough, and sized so as to grip the nipple tightly enough to prevent movement or loss during rough handling of the arm. The hammer struck the closed end of the cup, detonating the fulminate inside to flash through and ignite the propelling charge in the barrel. In a very short time, this "Percussion Cap" was to prove to be the greatest single development in the history of firearms until the advent of the self-contained metallic cartridge.

Unfortunately, the two French patentees have received very little credit for their work. In the United States, Joshua Shaw, British-born artist and dentist, was granted a percussion cap patent in 1822. This, despite the fact that the French patents of nearly two years earlier were not unknown here. In addition, there is considerable evidence that the percussion cap had also been developed in England. Egg, Purdey, Hawkes, and others of that country are known to have done work on caps and all hotly denied that Shaw's cap preceded theirs.

Shaw was granted an award by the 29th Congress in the amount of \$18,000 as full compensation for all U. S. Government use of his invention. The amount of this award was left to the discretion of the Secretary

of War, W. L. Marcy, who unaccountably raised the amount from the \$12,500 recommended by the Ordnance Office. The full \$18,000 was paid 4 May, 1847.

Reportedly, the award was granted on the basis of a report made to congress by F. W. Risque that no American or European percussion cap patents existed before 1822. This has already been shown to be completely erroneous and causes one to wonder just how Risque could possibly have overlooked two French patents and evidence of English developments. Apparently, Risque either did not bother to investigate the matter, or else deliberately ignored the earlier patents for reasons we'll never know.



The percussion cap of today differs not a whit mechanically from those in use a hundred or more years ago. It is just a simple soft metal cup containing a layer of detonating compound to be crushed against the nipple and ignited.

It is known that Shaw did do considerable work on the percussion cap in the United States. For a time, he was employed at Frankford Arsenal in production and further development of the cap.

The percussion cap had developed into two basic forms by the 1840's. Large sizes for military use were called "musket" caps and had an outward flange at the open end. The flange was solid on some, split on others. Small sizes for pistol and sporting use had no flange, being simple, open cups.

Some were smooth, others "ribbed." In the latter,

the walls of the cup contained shallow accordion-style, vertical folds. This design accommodated worn or odd-size nipples the best. It could be made slightly under-size, yet expand easily to pass over nipples of varying size and still stay securely in place. Smooth caps had to be rather carefully matched to nipple diameter to avoid looseness or splitting when pressed in place.

In production, open cups were stamped from thin sheet or strip copper in a single operation on a punch press. After cleaning and pickling, the cups were held mouth-up and a small amount of wet fulminate paste pressed against the inside of the closed end. Over this was pressed a disc of foil or waterproof paper which might then be sealed with a drop of varnish or lacquer. This produced a completely waterproof cap that would fire reliably under all weather conditions.

The percussion caps we use today differ only in that they are made faster on more modern automatic machinery and that pure fulminates are replaced by modern, non-corrosive detonating compounds. Physically, a cap made today is indistinguishable from one turned out at Frankford Arsenal 130 years ago.

Regardless of whom is given credit for its development, the percussion cap made reliable repeating arms possible. The Colt revolver and its many imitators depended upon caps almost entirely for its reliability, rapidity of fire, and speed of reloading. Revolvers had been designed around nearly every earlier ignition system, and yet none of them had proven even remotely acceptable for field use. But in the proving ground of the American Civil War, the bloodiest in history, the percussion cap clearly established its supremacy.

Oddly enough, man's ingenuity was accelerating, and the percussion cap was eclipsed almost in the hour of its glory. The first metallic cartridge began with the Swiss Johannes Samuel Pauley's centerfire, obturating, brass-case cartridge of 1812. It reached practical acceptability with the Smith & Wesson and Henry rimfire cartridge of the late 1850's, and by the end of the American Civil War had completely out-classed and obsoleted the percussion cap.



Chapter 4

SELECTION, REPAIR, AND MAINTENANCE

Care and maintenance of muzzle-loading guns presents a number of problems that you will not encounter in the modern, centerfire breech loader. Not only do we have to maintain guns in safe operating condition, we have to guard against the deterioration that will reduce their accuracy. On top of this, when starting with a used or original gun, we must be absolutely certain that it is safe for use. While both old and modern muzzle loaders have an entirely ample mechanical safety factor designed and built into them, they are manufactured of relatively soft metals and possess inherent characteristics that make frequent maintenance and occasional repairs essential.

Since modern muzzle loaders are in plentiful supply and quite economically priced, let's first take a look at what might transpire after you walk out of the store the proud possessor of a new front loader.

The majority of modern muzzle loaders are manufactured in foreign countries that have quite rigid proof laws. These laws require that every firearm, regardless of type, must be test-fired with heavier-than-normal charges and survive that firing undamaged before it can be offered for sale. In addition, guns that do pass this proof firing are required to be stamped with a symbol indicating that they have been so fired and inspected afterward and determined to be in safe, undamaged condition. All guns offered today by reputable importers and distributors have been proved by the manufacturer or by the official government proof house of the country in which they were made. However, occasionally, low-priced muzzle loaders that have not been proofed will show up on the market. The more reputable importers and dealers will make this known when they offer such guns for sale, but such behavior is not entirely universal. Consequently, if the purchase is your first, and you do not *know* that the gun has been proofed, prudence dictates that you attend to this detail yourself.

This is not difficult to do. Generally speaking, some load recommendation is supplied with the gun. By simply increasing the recommended powder charge by 25% you will have assembled a workable proof load.

In the case of revolvers or screw-barrel pistols, where limited powder space is available, simply use all of the powder that can be accommodated in the chamber without excessive crushing. If no standard charge data for your particular gun is available, then use the following chart. There is no need to exceed the 25% increase just mentioned; it is entirely adequate. Seeking to make your gun "safer" by using an excessive proof load is to simply run a much greater risk of damaging a gun that might very well have passed the 125% proof.

CHARGES AND LOADS FOR MUZZLE-LOADING FIREARMS

Blackpowder is now available in fg, ffg, fffg, and fffff granulations. Fg is the coarsest and fffff the finest. Choice of granulation depends in general on caliber and type of gun. The finest granulation fffff is for very small-caliber pistols and priming powder in flintlocks.

CHARGES FOR RIFLES, MUSKETS, AND HANDGUNS

Gun	Caliber	Weight of Blackpowder	Powder Granulation
Kentucky Rifle	.28	28 grs.	ffffg
Kentucky Rifle	.44	44 grs.	ffg
Rifle-Musket	.58	50-60 grs.	ffg
Smooth-bore Musket	.69	70-80 grs.	ffg
Smooth-bore Pistol	.54	25-35 grs.	ffg
Revolver	.31	12-15 grs.	ffffg
Revolver	.36	15-20 grs.	ffffg
Revolver	.44	20-25 grs.	ffffg

This table is intended as a guide only. Some guns may give best results with heavier or lighter charges, or different powder granulations than shown.

To establish a charge for Kentucky rifles, many shooters use the following rule: One grain weight of powder for each hundredth of an inch caliber. For example, 28 grs. powder for a cal. .28 rifle. Usually many different charges must be tried to determine which one gives best results.

LOADS FOR MUZZLE-LOADING SHOTGUNS

Gauge Bore	Diameter (inches)	Powder Charge (drams)*	Shot Charge (ozs.)	Class of Load
10	.775	4½	1½	hvy.
		4	1½	med.
		3¾	1¼	lgt.
12	.729	3¾	1¼	hvy.
		3	1¼	med.
		2¾	1⅛	lgt.
14	.693	3⅛	1⅛	hvy.
		2¾	1	med.
		2½	1	lgt.
16	.662	2¾	1	hvy.
		2½	1	med.
		2¼	1	lgt.
20	.615	2½	¾	hvy.
		2¼	¾	med.
		2	¾	lgt.
28	.550	2	¾	hvy.
		2	⅝	med.
		1¾	⅝	lgt.
32	.526	1¾	⅝	hvy.
		1½	9/16	med.
		1½	½	lgt.
.410- bore	.410	1½	⅝	hvy.
		1½	½	med.
		1¼	½	lgt.

*FFg blackpowder. Some shooters prefer fg powder for 10-ga. Patterning is generally better with light loads.

Proof firing must never be done from the hand or shoulder. Should a weak gun let go, serious injury to the shooter might very well result. The gun must always be fired by remote control from some form of rest. Considerable time and money can be spent to construct a very nice rest. However, it will not likely serve the purpose any better than an old auto tire to which the gun is lashed firmly.

Lay the tire on the ground, and insert the butt of the gun into the casing with the fore-end or barrel resting over the tire carcass opposite this point. A few turns of clothesline or heavy cord will secure the gun upright in place. Before placing in the tire, load, but do not cap or prime the gun. Once it's lashed down, attach a long cord or wire to the trigger and string out to a safe distance or to a position behind some sort of nearby barricade. Only after all this has been accomplished is it safe to cap or prime the gun.

Retire to the end of your cord, and give it a twitch to pull the trigger. If the gun misfires, stay right where you are for a full minute. An apparent misfire often turns out to be only a hang-fire. And, if you are leaning over the gun to check it at the time the hangfire lets go, the consequences could be somewhat disconcerting,



The cheapest and simplest method of tying a gun down for proof-firing is to place it in an old auto tire like this; then fire by means of a long cord or wire tied to the trigger. This old 12-bore double took the heavy charge in stride.

especially if the gun does prove to be defective and blows up.

If the gun has more than one barrel or chamber, only one should be loaded and fired each time. In other words, don't try to proof both barrels of a double, or all six chambers of a revolver by loading them all at the beginning and firing in rapid succession. If a defect does exist, firing one chamber can set all the rest off, creating a dangerous explosion.

After proofing, first examine all parts of the gun very carefully. Take particular pains to determine if there are any bulges in the barrel or any evidence of gas leakage at any point. If a caplock, check the position of the hammer immediately after firing. It should be fully down on the nipple. If it has been blown back to half-cock or full-cock, the nipple passage is surely oversized, and the mainspring may also be too weak.

After this visual examination, clean the gun thoroughly and disassemble it completely. Examine every part as closely as possible. Pay particular attention to the junction of breech plug and barrel, bolster and barrel, nipple and bolster—watching for any evidence of escaping gas. Should any gas be escaping, it might not be immediately dangerous in itself, but will certainly erode the metal to the point that the leak will become dangerous. Be on the lookout for any bulges or cracks that were covered by the stock.

Cracks in the metal can be particularly difficult to locate. They can exist, yet be closed tightly enough that no gas escapes through them. Under these circumstances, they cannot be seen except under fairly high magnification. Should you be fortunate enough to have access to electro-magnetic metal flaw detection equipment (Magnaflux) or die penetrant (Zyglo) equipment, by all means use it. Either will disclose flaws not visible

to the naked eye. However, lacking access to such services, stand the barrel upright and pour it full of a highly efficient penetrant such as "Mistic Metal Mover." The penetrant will find its way through cracks too small to be visible. The process may be speeded up by lightly tapping at random points on the barrel, or by applying slight pressure to the penetrant at the muzzle. Applying a few pounds air pressure by means of an expanding neoprene nipple clamped to the muzzle is about the only practical way of accomplishing this.

In any event, continuous examination of the entire barrel and breech plug surface for evidence of the penetrant leaking through is emphasized.

Most penetrants are highly volatile and, therefore, evaporate very rapidly. Since only a very small amount will seep through the cracks, it may easily evaporate before you see it if you allow 15 or 30 minutes to pass between examinations. Any leakage of penetrant through the barrel walls is cause for scrapping that barrel immediately. Some seepage around the breech plug can be accepted if the plug is secure. Of course, it goes without saying that the nipple or flash hole has to be securely plugged for a penetrant test. Incidentally, when the penetrant is poured out of the barrel, it's a good idea to clean the bore thoroughly with solvent and oil lightly. Some penetrants, leave a protective coating, others do not—rust can develop rather rapidly in the case of the latter.

The old-timers' off-quoted barrel testing procedure consisted of hanging the tube by a string and striking it sharply with a small hammer or knife butt. According to the story, if the barrel gave off a dead, thud-like sound, it was flawed. On the other hand, if a clear, bell-like ring resulted, the barrel was sound and in perfect order. This *is not* a valid test. Sound barrels will ring clearly, but so will some that are badly flawed or cracked. The dead sound does indicate a bad barrel—but the ringing *does not* necessarily indicate a good barrel. You can go ahead and use this trick to amuse your friends if you like, but don't use it to check out a barrel you intend to shoot.

After all the metal parts have been checked thoroughly, take a close look at the stock. Check carefully for any splitting or chipping in the area contacted by the breech plug. The breech plug and rear surface of the barrel transfer the bulk of the recoil loads, and if not perfectly fitted to wood, may split the stock. Chipping and splitting do not force scrapping of the stock. They may be easily repaired as outlined elsewhere, and this should be done immediately before any further shooting is undertaken. The lock recesses should also be inspected carefully for damage. If after all of this, your gun shows no defects resulting from the proofing, you may rest assured that it is safe for normal powder charges and bullet weights.

But, suppose that the gun you are using is an original that's been around 75 or 100 years. Or, that it is a

modern gun, but well used and worn. Proofing and examination procedures will remain the same as those just outlined. However, the gun should first be completely disassembled and carefully inspected for any visible defects of wood or metal. Any necessary repairs should be accomplished before proofing. This applies particularly to nipples, breech plugs, or bolsters in badly eroded condition. Proofing may well blow a loose nipple skyhigh. Or, if the passage be badly eroded and considerably oversized, back pressure may blow the hammer upward so violently as to damage the lock. You may be reluctant to spend much time in repairs before proofing, but those repairs may be essential if the gun is to pass proof. It should hardly be necessary to add that a thorough cleaning should accompany the pre-proofing inspection, and that all rust and other debris should be removed from the bore.

Speaking of bore debris, a surprising number of old guns remain loaded. Because of the difficulty of withdrawing the charge, it was not uncommon for a muzzle loader to be put away containing powder charge and bullet or shot. Eventually, as such guns passed from frequent usage, they were put away loaded. Many a gun carried home from the Civil War has been discovered in recent years to be fully loaded, except for a cap on the nipple. Several accidental firings and some injuries have been attributed to such long-ago-loaded guns. One flintlock fuzee came into my hands a few years ago, and turned out to be loaded. Drawing the charge produced wadding in the form of fragments of a French newspaper bearing a date in 1848. Seems it must have been loaded for over a hundred years.

It is easy to determine if the gun is loaded. Simply take the ramrod (or in the absence of same, a substantial length of dowel or rod that will go easily into the bore) and drop it into the bore until it comes to rest against whatever may be at the bottom. Make a mark on the rod at the muzzle, withdraw the rod, and measure its length from mark to tip alongside the barrel. If the rod extends down to nipple or flash hole, the arm is unloaded. If it lacks significantly in reaching this far, the gun is either loaded or clogged with debris of some sort, more likely than not the former. However, mud-dauber nests and lost marbles have been found in barrels more often than you might think.

Soldiers of the percussion and flintlock era used another method of determining whether their muskets were loaded, called "springing" the rammer. The gun was held vertical, and the steel or iron ramrod was dropped freely into the muzzle. If it struck the bare face of the breech plug, it gave off a clear sharp sound of uncushioned metal-to-metal contact. If, on the other hand, the rammer struck a bullet or powder charge, its impact was cushioned and a dull thud was heard.

When a new acquisition is found to be loaded, or for that matter, any other time one of your guns is loaded and it shouldn't be, the charge must be "drawn."

The traditional tool for this purpose is the "worm." It normally takes the form of a sort of double corkscrew attachment which screws onto the end of the ramrod. The ramrod, with the worm in place, is dropped down the barrel, and rotated clockwise while being held tightly against the bullet. This causes the points of the worm to dig into the soft lead of the projectile. Once a good purchase is obtained, you simply pull out the bullet by drawing out the ramrod. In the case of a gun that has not been loaded for a long period of time and whose barrel is reasonably clean, drawing the charge with a worm is, if not easy, at least possible without too much trouble. However, if the bore was badly fouled when that particular bullet was rammed, or if the load has been in place any great length of time, I prefer not using the worm.



Worms and ball screws take many forms. These are just a few of those available from Dixie Gun Works and other sources.

It isn't that the worm won't get a good grip on the bullet, but the end of the ramrod does not offer sufficient purchase to apply the power necessary to draw out a badly stuck ball. A transverse hole drilled through the rammer head to allow a stiff piece of drill rod to be inserted offers a much improved grip, not only for drawing out the ball, but for twisting the worm into the ball. Even with this added help, it becomes a two-man job to get that ball out. Instead of the worm, some shooters use a wood screw soldered to a bushing that screws to the end of the ramrod. The ramrod is bounced hard against the ball several times, causing the screw point to start a hole, and then rotated clockwise while under pressure to turn the screw into the ball. While this does obtain a much tighter grip on the ball, it also results in the ball being expanded tightly against the interior of the bore. This creates no particular problems in the case of a reasonably clean, smooth bore with a fresh load, but otherwise, it simply makes the ball grip the bore more tightly than ever.

Often a stubborn ball can be drawn more easily if penetrating oil, light oil, or even water is poured into the bore to provide lubrication. With an old gun or a particularly stubborn ball, considerable time and profanity can usually be saved by dismantling the gun, unscrewing the breech plug, pouring out the powder charge, then driving the ball out the breech by means of a long, bore-sized rod inserted through the muzzle. This method is absolutely certain to work, no matter how tightly the ball may be stuck. In the case of an

old, neglected gun, removal of the breech plug might present a problem, but we'll get into that shortly. Charges may be drawn from revolvers through the barrel by use of the worm, but this is really doing it the hard way. Simply remove the cylinder by whatever method the gun design dictates, and unscrew the nipple(s) from the offending chamber(s). Loosen the powder charge with a nipple prick or piece of wire, and pour it out through the nipple opening. After this, insert a piece of steel rod that will just pass through the threaded nipple hole, and use it as a punch to drive the ball forward out of the chamber. With some makes of revolvers, the cylinder need not even be removed. The nipple can be unscrewed and the rod inserted following the capping groove or clearance cut.

Drawing the charge from a muzzleloading shotgun normally presents no problem whatever. Even in a much-abused, long-loaded gun, the overshot wadding is easily penetrated by a worm or screw. The wad may be rusted tight to the bore, but can be broken up sufficiently to get the shot out without difficulty. The same may be said of the filler and over-powder wads, though their greater combined thicknesses makes it a bit more difficult to break them up if they will not slide freely in the bore. Of course, once the charge is completely removed, fragments of wads clinging to the bore walls must be scraped out if the next round is to be more than indifferently loaded. Often firing two or three rounds will clean out the residue of the original lodged wads.

Whether it be old or modern, the first step (after visual inspection and making certain it isn't loaded) in determining that a gun is safe and shootable, or making it that way, consists of complete disassembly. Quite often it is very difficult to disassemble such guns without damaging them. Age alone has little bearing on this difficult disassembly.

One frequently encounters Civil War Era guns that have been kept clean and well lubricated for their entire life. Consequently, they can be separated part from part with little if any more difficulty than a gun fresh from a factory. On the other hand, I've encountered modern percussion revolvers a few years old that were so clogged by rust and abuse that their disassembly was a major operation.

Since modern muzzle-loading guns are identical in design and configuration to those of a century or more passed, there is no point in differentiating between them in regard to disassembly instruction. We'll start from scratch—long guns and single-shot pistols first—then revolvers.

A careful visual inspection is first in order. Make certain that you know which parts must be removed first, or you may very well damage some irreplaceable component. For example, I have known Kentucky Rifle stocks to be broken in attempts to remove the barrel simply because a single barrel pin had been overlooked.

A clean gun is going to be easier to disassemble, so scrub the grime and the accumulated grease and oil off all external surfaces, both wood and metal with a small, stiff bristle brush and mild soap. Don't let the wood soak up water—wet the brush, stir up a good dryish lather on its bristles, and use this to do the scrubbing. Clean the bore as well as its condition will allow. Utilize scrapers filed from brass to very carefully clean all debris and rust out of screw head slots. Any attempt to loosen a stuck screw is certain to produce damage unless the slot for the driver can be used to its full depth.

With everything cleaned up take screwdrivers that fit the screw slots perfectly and make a tentative try at loosening the individual screws. Unless they break loose with relative ease, go no further or you'll ruin the heads. Apply a good grade of penetrating oil or rust-freeing penetrant such as "Liquid Wrench" or "Mistic Metal Mover." Where both ends of the screw are accessible, apply it to both places generously. Next, take a brass drift and rap the head of each screw smartly two or three times to aid the penetrant. Let set an hour or so, and try the screws again. If they still don't move freely, repeat the penetrant and rapping treatment. Several days of this treatment, frequently repeated, is sometimes necessary to loosen the screws. Don't get in a rush. It is far more practical to take several days in freeing a screw than to break it off and have to drill out and replace it.

If, after a reasonable period of time this treatment fails, insert the screwdriver bit in the slot, and strike the driver sharply with a small hammer several times. Generally, this treatment will loosen all but the most stubborn screws, providing sufficient slot remains by which to turn them. In the event you encounter a screw whose slot is so badly chewed up as to be unusable, or one whose head was filed smooth in assembly, thereby, destroying the slot, use a hand grinder (such as the Dremel Moto-Tool) with a small metal-cutting slitting saw or abrasive cut-off disc to cut a new slot or clean up the old one. If all else fails, chuck a screwdriver bit in a drill press, with the gun clamped to the press table. While applying downward pressure on the driver with the press spindle, rotate the chuck by hand to break the screw loose.

If a screwhead breaks or the shank twists in half, a drilling job is in order. Carefully centerpunch the remains and drill through with a bit whose diameter is about half that of the screw shank. Go slowly and carefully. Open this hole up with successively larger drills until the screw remnants can be picked out. Do not use a drill large enough to spoil the threads into which the screw is turned. By going up in small steps, a point can be reached where the bit just touches the threads without harming them. If screw fragments can't then be picked out of the threads, chase them out with a tap of the correct size.

Once the screws have been loosened, don't get carried away and take them all out. When you have succeeded in loosening each of the exposed screws $\frac{1}{4}$ to $\frac{1}{2}$ turn, give them another shot of penetrating oil and turn them back in finger tight.

Now, or during the period of time you were waiting for the screws to soak loose, locate all barrel retaining devices—pins, wedges, keys, and/or bands. Pins are simply driven straight out with a punch of slightly smaller diameter than their own. Keys and wedges must be examined very carefully to make sure no hidden retaining device is sheared off in driving them out. When made of iron or steel, keys and wedges are often rusted in position and must be given the penetrating oil/tapping treatment to break them loose. Bands are usually retained by a spring catch or pin. The pin may be driven out easily enough. Spring catches often cannot be depressed far enough to allow the band to be moved because of debris filling the clearance cut under them. This debris usually consists of dust and dirt mixed with oxidized oil and grease and can be dissolved or softened by repeated applications of carbon tetrachloride or good solvent. I find carbon tetrachloride best, and it may be applied with considerable pressure by means of a syringe and hypodermic needle. By squirting a jet of carbon tet under the band spring, the accumulated debris of years can be washed out, allowing the spring to be depressed.

At this point, you may discover—if a sporting arm—that your gun has a "patent breech." This means simply that it is fitted with a hook-shaped breech plug which engages under a separate tang. If so, the barrel may be lifted free of the stock. Elevate the muzzle, and the breech plug will disengage from the tang and the entire barrel may be lifted out of the stock. If the barrel resists being lifted at the muzzle, then it is either fitted with a solid breech plug/tang or is rusted tight to the stock. In either case, *don't force it*. The next step is to free the tang from the stock. The tang screw must be turned out of its engagement with the trigger plate and drawn clear, freeing the tang. Try again, lifting the barrel muzzle. If the barrel and/or tang still appear to be stuck tightly to the wood, take out the lock plate screw. In some guns, this screw passes through a reinforced portion of the tang or breech plug, further securing it to the stock. With it removed, try again. As the barrel lifts from the stock, be very cautious that it does not peel out large splinters of wood that are adhering tightly to the metal. If any splitting starts, work carefully with a thin, sharp-pointed knife blade to separate wood from metal. If pieces of wood unavoidably come out with the barrel and tang, save them to later be glued carefully back into place.

Lay the barrel and tang aside. If the metal is heavily rusted where covered by wood, saturate with light oil which can be working while you proceed with further disassembly. Also, run penetrating oil down the barrel

where it can work on the breech plug threads, and also apply some to the external junction of plug and barrel. A few sharp raps on the plug with a brass hammer will assist the oil in penetrating the joint.

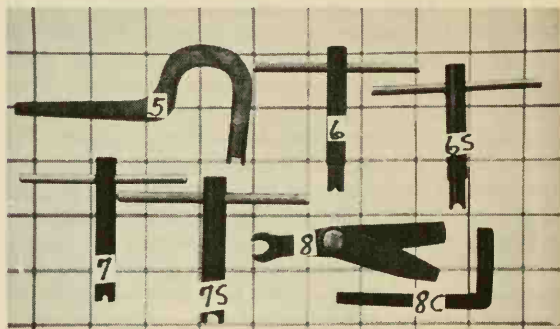
Removal of the lock is next. In most instances, only the lock plate screw already mentioned holds the lock in place. However, you may occasionally encounter a reinforcing screw or bolt inserted from either side. If either is present, turn it out. Additional screws may also be found securing the side plate opposite the lock. The lock is quite likely stuck tightly in its mortise. Tap very gently around its edges to break it loose—being careful to avoid bruising the wood. Turn the gun lock-down, and rap on the opposite side of the stock with the heel of your hand. Often this is sufficient to free the lock and cause it to drop out. If not, insert the lock screw from the left and turn it into the lock only one or two threads. Gently tap the protruding head of the lock screw with a brass hammer to start the lock from its recess. Watch carefully to insure that the edges of the mortise in the stock are not being splintered. The lock must come out squarely, or some splintering will surely take place. Once the lock has started moving, the lock screw may be turned in from the right side and used as a handle, in conjunction with the hammer, to gently work the lock clear of the stock. At this point, the best treatment for the lock is to drop it into a container of solvent or carbon tetrachloride where for the next few days the many year's accumulation of oil, grease, and dirt can be soaking loose.

Locate the pins securing the trigger guard to the stock. In addition to, or in place of pins, you may find wood screws entering vertically from beneath. Remove them and lift out the trigger guard. Often the trigger plate will have been secured in place only by the tang screw, but there may be another wood screw or a pin or two as well. Whichever the case, remove the trigger plate.

At this point, set the stock aside. We'll cover its rejuvenation and/or repair a little farther on. One word of caution—*don't* lean it against the wall or stand it in the corner. Particularly, if the humidity is high in your area. The long, slender fore-end may warp badly from its own weight, having been deprived of support of the stiff barrel. Your best bet is to tie a cord around the fore-end tip and hang it somewhere.

At this point, we can get back to the barrel group. If the gun has seen much use, the nipple will very likely require replacement. Make certain you have a nipple wrench that fits the nipple properly. More nipples are ruined by improper fitting wrenches than by any other single cause. If you do not have a wrench that fits correctly, clean up the opposing flats on the nipple with a small file. Then, clamp a small adjustable (crescent) wrench tightly on these flats and unscrew the nipple. Even if the nipple looks "good enough," it should be

replaced with a new one made from an alloy that will not erode as rapidly as the older types. Use an "Ampco" which is noted for its long life. Check the condition of the nipple threads in the bolster. If they are clean, sharp, and full, simply order an Ampco nipple to fit. If the threads are badly rusted or chewed up, order the next larger size nipple and a tap with which to "chase" new threads to fit. The bolster will probably be fitted with a "clean-out" screw running in from the right side. This should be turned out, and the conditions of the threads checked. If they are badly worn or chewed up, they should also be recut and a larger screw fitted. At this time, the interior of the bolster should be cleaned and checked to insure that it offers free passage from the nipple and directly into the bore.



Nipple wrenches will be found in a wide variety of forms, but the T-Handle type shown here is the most common of modern production. It works well if properly made, dimensioned and hardened, but some of the older types like No. 5 above give more leverage for loosening rusted nipples.

The bolster itself may be either welded, brazed, or threaded to the barrel. Generally speaking, if there are opposed flats on its outer end to fit a wrench, it is threaded in place. If so, it, too, should be turned out and the condition of the threads checked carefully. These threads should also be refurbished, if necessary, but this will necessitate fitting a new bolster. Fortunately, they are available in many sizes and styles from Dixie Gun Works.

The breech plugs of many older rifles are seemingly immovably rusted in place. The secret of their removal lies in having the barrel securely clamped in a heavy-duty vise, using a carefully fitted wrench on the plug, and breaking the plug loose by impact, rather than steady pressure. Clamp the barrel tightly between copper-faced vise jaws. Make sure the breech of the barrel overhangs the bench sufficiently so that the wrench used on the plug can be rotated through a full circle. If the sides of the breech plug are parallel and flat, a large, old-time "monkey wrench" or a large adjustable crescent wrench can be fitted tightly and do a good job. If, however, there is vertical and/or longitudinal

taper to the plug and tang, then you'll have to file and hacksaw a close-fitting opening in the end of a 12" or 18" bar of $\frac{1}{2}$ " x 1" steel. A poorly fitted wrench is bound to damage the plug, and may not start it properly from its seat.



One of the simplest forms of breech plug wrench is this. A bar of steel is simply forged around a form, and then filed to fit the tang closely. A close fit is necessary to avoid damage to the plug. With torch, hammer and anvil you can make one of these in 20 minutes. They are available ready-made from Dixie Gun Works.

With the barrel tied down solidly, strike the end of the wrench handle a light, exploratory blow with a heavy (2 lb.) hammer, driving it counter-clockwise. Often only a single moderate blow will readily break loose a plug that resisted your full weight of steady pressure. If the first blow doesn't do the job, a second or third heavier one will invariably suffice.

Clean and inspect the threads of both barrel and plug. The same criteria already described applies here. If the threads need restoration, have a lathe operator recut the existing thread in the barrel, increasing its diameter only as much as is necessary to clean it up. He can then thread a new, blank breech plug (available from Dixie Gun Works) to fit. However, if in the interest of maintaining originality, you would prefer to use the original plug, simply have a good welder build up the threaded shank and cut new threads on it.

Since the miscellaneous parts are removed from the barrel, now is the time to do whatever work you intend, or is necessary, on the bore. If rifled, and in reasonably good condition, I recommend nothing more than a vigorous cleaning at this time. Of course, if the rifling is ruined, it will have to be recut before you can expect anything like decent accuracy. If the barrel is a smooth bore, it can be polished with strips of fine abrasive cloth placed in the end of a slotted rod and spun by a portable electric drill as it is passed back and forth through the barrel. Actually, I'd prefer the barrel be used as is unless it is completely ruined.

Now is also the time for external refinishing of the barrel, while all of the protuberances are removed. This procedure is described elsewhere in this volume, so we will pass over it for now.

Assuming that you have everything about the barrel properly cleaned and re-threaded where necessary, return all the parts to their respective places. Take care to maintain the original alignment of drum, nipple, and breech plug. If the parts screw in past their original stopping point, either peen the mating shoulders out

slightly or use thin *steel* shim stock so that they will draw up tightly and stop in the right position.

If the gun you've been working on is a flintlock, check the diameter of the flash hole. If it is over $3/32$ " and appears roughened and eroded, it requires repair. A stainless steel insert makes by far the best replacement vent. The old vent can be drilled out and tapped $1/4$ x 28 threads per inch, after which the replacement stainless vent sold by Dixie Gun Works can be screwed in tightly. Of course, you can make a vent insert out of a stainless steel screw or threaded rod stock, but with the DGW inserts available at 50 cents each, it hardly pays to do so. So much for the vent.

By now, the lock should have soaked well enough in solvent so that it can be cleaned fairly well by scrubbing with an old tooth brush. Careful brush work will clean most locks well enough that they will function reliably without requiring detailed disassembly. However, we prefer to take it completely apart. One item is absolutely essential for proper dismantling — a spring vise. This is available from most purveyors of muzzle-loading equipment and supplies; however, you can make one quite simply from a pair of cheap pliers. Grind or file the jaws of the pliers so that they will reach in and fit around the two arms of the mainspring which can then be compressed by squeezing the handles. Then, drill and tap the pliers handles so that a long stove bolt can be inserted and turned up to close the handles and lock them in any position. With this tool, compress the mainspring sufficiently that it can be lifted out of engagement with the lock plate and the stirrup. Unless reassembly is to take place within a relatively short period of time, release the spring vise and let the spring relax.

Turn out the hammer screw. Check to make certain that the hammer is snug upon the tumbler axle. Even the smallest amount of play will increase very rapidly as the gun is fired. This condition can be corrected only by welding the square hole in the hammer, and then carefully filing it to a very snug fit on the tumbler. It would seem easier to weld and reshape the tumbler. This would destroy the heat treatment essential to maintaining a safe trigger pull. If the hammer does not lift easily off the tumbler, turn the lock plate over, hammer-down, and rap on the bridle with a block of wood or a plastic hammer. If this doesn't loosen the hammer so it can be lifted off, then make two narrow metal wedges, preferably of brass, and tap them gently between hammer and lock plate from opposite sides in line with the tumbler. Tap them in equally so that pressure applied to the hammer is in line with the tumbler. Pressure applied only to one side of the hammer will simply cause it to bind even more tightly on the tumbler. Examine the hammer screw carefully, and if it is not a good, snug fit in the tumbler or if its driver slot is badly chewed up, replace it with a new hardened screw. Check the face of the hammer. If it shows evi-

dence of uneven bearing of the nipple, wait and correct this after the gun is completely assembled. If the hammer face is pitted and rough, grind or polish it smooth with a mounted stone in a hand grinder. Do not destroy the lip around the hammer face, since this helps protect one's own face from cap fragments.

Next, turn out the two bridle screws and lift the bridle off; thus, also freeing the sear. Turn out the sear spring screw and remove the spring.

Only the tumbler remains to be removed from the lock plate. If it can not be drawn out from the inside of the plate by the fingers, turn the plate over and drive it out with a soft drift. Drive out the small pin retaining the stirrup, and the percussion lock disassembly is complete.

Disassembly of a flintlock is virtually identical to the foregoing except that the frizzen spring must be compressed and removed, and the frizzen screw turned out to free that part. Then, the top jaw and screw of the cock (hammer) must be removed.

The average black powder buff won't be able to do a great deal to the internal lock parts except to carefully clean off rust and replace ill-fitting screws or broken parts. Burrs may be found on the moving parts, and these should carefully be removed with hard Arkansas stones. The sear nose and sear notches in the tumbler can be polished to improve trigger pull, but under no circumstances should the angles or depth of engagement be changed. Occasionally screw hole threads in the lock plate will be stripped or badly worn. About the only cure for this is to chase the hole out to the next larger size thread that will produce a full-depth thread. Once this is done, then a special screw must be made and the hole enlarged to fit. Usually no great amount of enlargement is possible because of the small size of parts such as the bridle, sear, and sear spring. An alternative is to re-thread the lock plate hole, and then screw it into a threaded stud over which the internal parts will fit without enlargement of their holes. The protruding end of the stud may then either be tapped for a retaining screw or threaded for a lock nut. As a last resort, the holes in the lock plate may be welded up and redrilled, but this may warp the plate.

A common repair required to place a flintlock in service is re-surfacing and re-hardening the face of the frizzen. While this can be done at home, the results are often far from satisfactory. Most gunsmiths who do muzzle-loading work will reface and harden a frizzen for a very nominal cost. The best solution is to let one of these gentlemen do the job. The frizzen requires re-surfacing and hardening if it shows deep scratches and gouges from contact with the flint, and if it does not produce a good shower of sparks from a new flint set properly in the jaws of the cock.

After all of this, and unless you are awfully fast and eager, it will have taken a good many evenings, reassemble the lock and place it and the trigger and

trigger plate back in the stock. Check to make certain that the trigger position allows full engagement of the sear at both half- and full-cock. At the same time, insure that there is not excessive free travel of the trigger before it contacts the sear arm. The trigger should just barely touch the sear arm with the hammer at full-cock and the sear fully down in the notch. Any trigger play that does exist can be taken up in one of two ways. Simplest and quickest is to inlet the trigger plate slightly deeper into the stock. Alternatively, the rear of the trigger may be built up by welding or brazing, then filed down to give proper sear contact. If the trigger does not allow full sear engagement, it can either be filed down, or a shim placed under the trigger plate in the stock.

This completes the essential metal work in thoroughly checking and repairing a well-used muzzle-loading shoulder arm. Refinishing of the metal and the stock is covered elsewhere in this book. Consequently, all you need to get the gun talking again is to clean out dirt and grease from the inletting cuts in the stock with carbon tetrachloride and place all of the metal parts back into the wood.

This may seem like an inordinate amount of work to do on a gun that looks pretty good from the outside. However, until you had done all this work, you didn't really know that the gun was safe — no matter how good it looked.

Percussion revolvers are a somewhat different breed of cat, and carry with them a somewhat different set of problems. The Colt design usually gives the most trouble, so we'll take a look at it first.

Complete disassembly and *thorough* cleaning is the first order of business. Remove the barrel wedge, first turning out its screw on the left side of the barrel, then depressing the catch on its right end, and tapping it clear of the barrel to the left. If luck is with you, the barrel may be drawn off the base pin. However, if it resists hand pressure, place the hammer at a half-cock and rotate the cylinder so the solid metal between chambers falls directly under the end of the rammer. Unlatch the rammer arm, and bring it down so that the rammer contacts the cylinder solidly. Pressure on the rammer arm will jack the barrel free of the base pin if it is not stuck too tightly. Only hand pressure should be applied to the rammer arm. After all, it was designed only to seat bullets, and will bend if overloaded. Never strike it with a hammer attempting to break the barrel loose from the base pin.

If the foregoing fails, apply penetrating oil generously through the wedge hole and where the base pin enters the rear of the barrel. With a fiber hammer, tap vigorously over the portion of the barrel through which the base pin passes to assist the penetrating oil in working its way through. Wait an hour or so and try the rammer again. Repeat this treatment at frequent intervals until either the barrel comes free, or you give up.

If this fails, complete the other stripping, and then clamp the frame tightly in protected vise jaws and place a solid wood rest under the barrel. Then, take a brass or aluminum drift and place it solidly against the rear of the barrel where it meets the cylinder. Strike the drift sharply with an 8 oz. hammer which is reasonably certain to break the barrel loose from the base pin. It is also quite likely to make a dent or two at the rear of the barrel, but this is better than having to drill out the base pin which is the only alternative.

If the hammer and drift method fails, and it seldom will except with a very badly rusted gun, the head of the base pin should be carefully center-punched where it appears in the hammer recess at the rear of the frame. It may then be drilled out, using successively larger drills so as not to damage the threads in the frame. Base pin and barrel may then be punched out from the rear of the frame, after which the barrel can be clamped in a vise and the ruined base pin twisted to break it loose from the barrel. The remnants of the old base pin must then be chased out of the threads in the frame and a replacement pin carefully fitted. This is a job for an expert, and I do not recommend that the average home mechanic attempt it — even though new replacement pins are available from at least a couple of sources.

Back to the beginning, and assuming that you got the barrel off easily. Remove the rammer screw and disassemble that unit from the barrel. Scrub the bore and the base pin recess and clean all dirt out of the wedge recess. Check the muzzle for burrs that intrude into the bore, and carefully remove them with a countersink if they exist. Rammer screws and catches are often badly worn; fortunately, replacement parts are readily available.

Slide the cylinder off the base pin, and with nipple wrench remove all nipples. They will probably require replacement if the gun has seen much use. If you anticipate any significant amount of shooting, it is best to install all new Ampco nipples in the same manner as already described. Scrub the chambers thoroughly, removing rust with steel wool or fine abrasive cloth in a slotted rod spun by a portable electric drill. Since there is very little metal between chambers, be very careful not to remove any more metal than is absolutely necessary to clean out rust. Before doing this, check carefully for outside dents which bulge into the chamber. Any deep dent of this sort will result in a very thin spot in the chamber wall after the chamber is polished. This can be avoided by using a shortened version of a shotgun dent remover to force the metal back where it belongs.

Check the chamber mouths for burrs and carefully file or stone off any that are found. Lay the cylinder aside.

Turn out the two screws flanking the hammer that hold the backstrap in place, and also the single screw

at the lower forward corner of the grip. These screws naturally get the same treatment already described for recalcitrant fastenings. Pull the back strap off, and the one-piece grip may then be slid off the trigger guard to the rear. Observe where the tip of the mainspring engages the hammer, depress it and rotate the spring sideward to clear the hammer. Turn out the mainspring screw and lay both units aside. Turn out the three screws holding the trigger guard in place and lay those pieces aside.

Turn out the bolt spring screw and remove the spring. Remove the trigger screw and the trigger will drop out. Turn out the hammer screw and carefully slide the hammer down so as to not lose the hand. One more screw, that holding the bolt, comes out and disassembly is complete.

Toss all the small parts and screws in a container of solvent to soak. Screwheads are usually pretty badly battered, and since replacement screws are readily available at low cost, it's best to go ahead and get a complete new set.

Scrub all of the dirt and debris out of all the frame recesses. Clean off any burrs that intrude into any of the recesses.

The base pin is the heart of the Colt design, so check carefully to make sure it is tight in the frame. If there is any wobble whatever, the gun will shoot loose in short order. If it is loose, a temporary fix can be accomplished by centerpunching around the perimeter of the pin where it is exposed in the hammer recess at the rear of the frame.

If the base pin is solid, place the cylinder on it and determine whether excessive cylinder play exists. There is no specified tolerance for this fit; the cylinder should simply fit as snugly as possible and still rotate freely. Looseness can be corrected within the cylinder, in either of two ways. The simplest consists of counterboring the front and rear end of the base pin hole, pressing in bushings, then machining the bushings to a slip fit on the base pin. The alternative is to bore out the hole its full length, then press in a full length sleeve which is then reamed to a slip fit on the base pin. Both of these methods are beyond the capabilities of the average black powder shooter. Any competent gunsmith or machinist can do the job without much difficulty and at no real great cost.

If the base pin itself must be replaced, then the cylinder should be sent with the frame to the smith doing the job. He can then utilize an oversized base pin and fit the cylinder correctly to it.

After the base pin/cylinder relationship has been taken care of, replace the barrel on the base pin and tap the wedge in place. The barrel should be snug without binding on the base pin, but without any play whatever. In addition, it should be drawn up snugly against the frame, with the alignment pins at the forward end of the frame seating fully in their respective

recesses in the barrel lug, and preventing any side work rotation. The cylinder should rotate freely without dragging on the rear face of the barrel. On the other hand, the gap between barrel and cylinder, with the cylinder as far forward as it will go, should not be more than .006". Correcting an excessive gap here is rather difficult. It can only be done by partially welding the front of the wedge cut in the base pin or the rear of the wedge cut in the barrel, and then filing the hole to size and removing a comparable amount of metal from the barrel lug where it contacts the forward end of the frame. In this manner, the entire barrel can be drawn farther to the rear. Generally speaking, the saving of a few feet per second in velocity that can be achieved by closing up the barrel/cylinder gap in this manner is not really worth the trouble and expense of the job. Accuracy does not suffer significantly from an oversized gap, but velocity does drop off. However, a slight increase in powder charge can compensate for this.

With barrel and cylinder matched back to the frame, check the hammer, hand, trigger, bolt, and bolt spring. If these parts all appear serviceable, and function well enough to index and lock the cylinder positively when the hammer is brought to full-cock, don't concern yourself with them at this time.

Reassemble the gun completely, and refer to other chapters concerning refinishing, etc.

The Remington design has a solid frame and fixed barrel. Consequently, one simply removes the rammer screw and draws out the rammer, which then allows the

cylinder base pin to be removed. Then the cylinder can be lifted free of the frame. Removing a single grip screw allows the grips to be taken off and provides access to the mainspring for its removal. Take out the single screw at the forward end of the trigger guard, and the guard lifts off, making way for the action parts to be removed after their screws are turned out.

The barrel, frame, and cylinder should be given the same general treatment as already outlined for the Colt. Tightening the cylinder on the base pin is relatively simple. Any machinist can either bush the cylinder, or very quickly turn out an oversized replacement base pin.

The Remington action functions essentially in the same manner as the Colt, though the bolt is pivoted to the trigger, rather than separately.

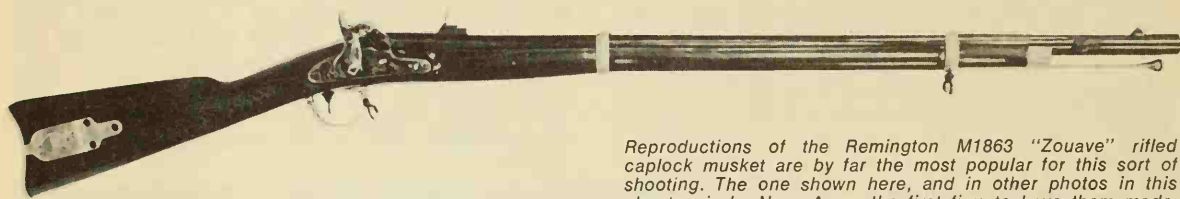
Aside from these differences, albeit, with considerably less time and effort involved, the Remington Percussion Revolver can be treated as the Colt.

Refurbishing an old or well-used modern percussion revolver does involve the expenditure of a good bit of time and effort. However, if you want a gun that is accurate, reliable, and safe, the essential operations must be carried out. If you haven't the time or inclination to take care of these details, then you will be far better off by beginning with a new, modern copy of the original item. It may not be as romantic as shooting a gun that might have been used in the Civil War or one of the Indian campaigns, but it is certainly more practical.



Chapter 5

SHOOTING THE CAPLOCK RIFLED MUSKET



Reproductions of the Remington M1863 "Zouave" rifled caplock musket are by far the most popular for this sort of shooting. The one shown here, and in other photos in this chapter, is by Navy Arms, the first firm to have them made.

The sporting guns are nice to shoot. They have grace and beauty found in few mechanisms — a fine Kentucky is a delight to all the senses and comes to shoulder with the ease of a zephyr-wafted feather. More man-hours have been spent on beautifying some fine sporting muzzle loaders than it takes to build a Cadillac. To see a fine Whitmore or similar example of the gunmakers art is closely akin to viewing an Old Master or the Parthenon.

Target rifles will lay there and punch neat holes in 40 rod paper all day long. They satisfy our urge to seek perfection of performance at any cost. They are fun to shoot, too, but are practical for little else than paper-punching. We like them, of course, and to see them perform on the line at Friendship can stretch one's credulity. But there is one truly utilitarian front-loader that can be shot reasonably well by anyone — and it doesn't cost a fortune, and it doesn't have to be custom-made. You can buy one off the counter with little or no difficulty, for less than friend wife pays for a hairpiece or new spring outfit.

It's the Caplock Rifled Musket, manufactured by uncoun ted millions the world over, during the middle third of the last century. With few exceptions they are sturdy, rugged guns with all the grace and aesthetic appeal of a wagon tongue. They are heavy, bulky, and come to shoulder like a cedar post. But, for all that, the rifled musket has tremendous appeal all its own.

For one thing, there's hardly a man among us who can't claim some near or distant kin who strug-

gled through Chicamauga, Gettysburg, or some similar bloodletting with an Enfield or Springfield "Minie Gun" in hand. With an original or reproduction of that arm in hand, one's mind slips so easily into imagined scenes of blue and grey uniforms appearing wraithlike through billows and tendrils of white, pungent black powder smoke. As you stand there, the faint voices of long-dead drums and bugles can be heard, along with the crash of caisson and carriage wheels, the scream of horses and the hoarse, inarticulate cries of valiant men lunging toward their fate.

In short, the rifled musket creates in one a feeling that can never be produced by the most beautiful Kentucky or most accurate 40-rod gun ever built. With it, we can re-live history that is still close enough behind us to have real meaning.

Seemingly, from what we've heard and seen, the military arm of our Civil War is by far more popular among black-powder shooters than any other type. I like *all* the caplock guns, but as this is written, a Navy Arms "Zouave" copy of the Remington M1863 .58 caliber U.S. rifle leans against my desk. It's as faithful a copy of the original as one could want.

If you aren't interested in shooting this type, it must be simply because you've never held one in your hands, or else just don't like to shoot *anything*. If you're one of the latter, you probably borrowed instead of bought this book, but there may be some small hope for you yet.

To shoot we must have a safe and serviceable gun,

so let's take a look at what's available. The days when "War Surplus" British, U.S., or other nationality caplock rifles could be picked up for a couple bucks each have long since passed. Drool all you want over Bannerman's old catalogues, but bargains like that just aren't to be had anymore. Even so, quite a few of the hundreds of thousands of rifled muskets left over from our Civil War are still around. And, occasionally, a small lot of recently discovered foreign military guns will show up in the hands of surplus dealers. Some of these have turned out to be superb arms, virtually equal in quality and accuracy to top-grade commercial models of the same period.

The basic Union arm of the Civil War was the M1861 .58 caliber rifled musket. Produced extensively at Springfield Armory, it was procured by hundreds of thousands from numerous commercial sources, some good, some bad. Consequently, it is the most common today and, when in good mechanical condition, an excellent shooting arm. One of this model in fine shooting condition may be encountered today for up to \$200 — a pretty good piece of change for any of us. A specimen that can be put into even reasonably good shootable condition will easily bring half that much, even though it looks pretty rough.

The later M1863 rifled musket is also not too difficult to find and at about the same price, and is thought of quite highly by shooters.

The second most common surviving caplock military rifle in the country is the ubiquitous .577 caliber British "Enfield" of which several hundred thousand were procured by both Blue and Grey. The entire British small arms industry grouped loosely around Birmingham seems to have enjoyed unusual prosperity while producing Enfields for *both* sides of the Civil War. In "Civil War Guns," Wm. B. Edwards indicates over 700,000 arms were exported from there in 1861 alone. Of course, not all of them were the Enfield rifled musket, but a substantial portion were.

The Enfields probably shoot just as well as the M1861 and M1863 rifles, but are usually picked as a "second choice" by hard-to-please shooters. On today's market, the Enfield is just as costly as the original Springfield M1861 or M1863, so there is really nothing to be gained by shopping specifically for it.

Of course, there are dozens of other different makes and models suitable for shooting. Generally, they did not survive in sufficient numbers to be easily come by now. Collectors have priced them out of the shooters' reach. Rifled British Tower muskets in .69 caliber show up now and then — and they don't shoot too badly.

If you do decide to use an original gun for shooting, please keep in mind that it won't last forever. An average-condition specimen may be shot a reasonable amount — if cared for carefully — without significant-

ly affecting its value to collectors. However, any *visible* deterioration resulting from shooting will depreciate its value. A gun in really fine original condition simply shouldn't be shot — too few have survived this long to be able to justify reducing their number any further. As for a "mint" gun — to shoot it would be an extreme act of folly. Please don't.

Original guns must be *completely* disassembled and carefully checked and inspected before shooting. This is explained in detail elsewhere in this book.

By far the most economical and practical approach to acquisition of a "shooting" rifled musket is to buy a new one. Yes, a new one! Very fine reproductions of the basic M1863 rifle are produced in Europe and sold here at prices ranging up to \$125. While these reproductions may lack the fine hand finish of the old guns, they are made to closer tolerances and from better materials. Outstanding in this group is The Navy Arms Corp., "Zouave," copied directly from the Remington contract piece made from 1863 onward, at \$75.

This model follows the contours of the original very closely. With its polished brass furniture, bright steel ramrod, and blued barrel, it is a most colorful sight. It is well made of modern materials and certainly superior in strength to the originals. It is proofed with a heavy charge of special "proof" black powder by its manufacturer. As it comes from the box, it need only be degreased and checked over and it is ready for the range. Certainly this is far less trouble than completely overhauling an original gun. And, in the long run, it will be far, far less costly.

Other firms offer less expensive reproductions of Civil War vintage rifled muskets, their quality ranging from "acceptable" to excellent. As with most things, you get about what you pay for — so I suggest buying the best you can afford.

In any event, let's assume you've selected your gun — old or new — and that it is now in perfect mechanical condition. Also, that it is in essentially as-issued configuration, with open sights, full stock, and equipped with iron or steel ramrod.

What else do you need? First, ammunition in the form of musket ("top-hat") caps; a can of ffg or ffff granulation black powder; and a supply of *pure lead* .58 caliber minie bullets properly lubricated.

If you are casting your own bullets, be sure to follow the procedures outlined in the chapter devoted to various projectiles, their fabrication and preparation for shooting. All grease grooves should be completely filled.

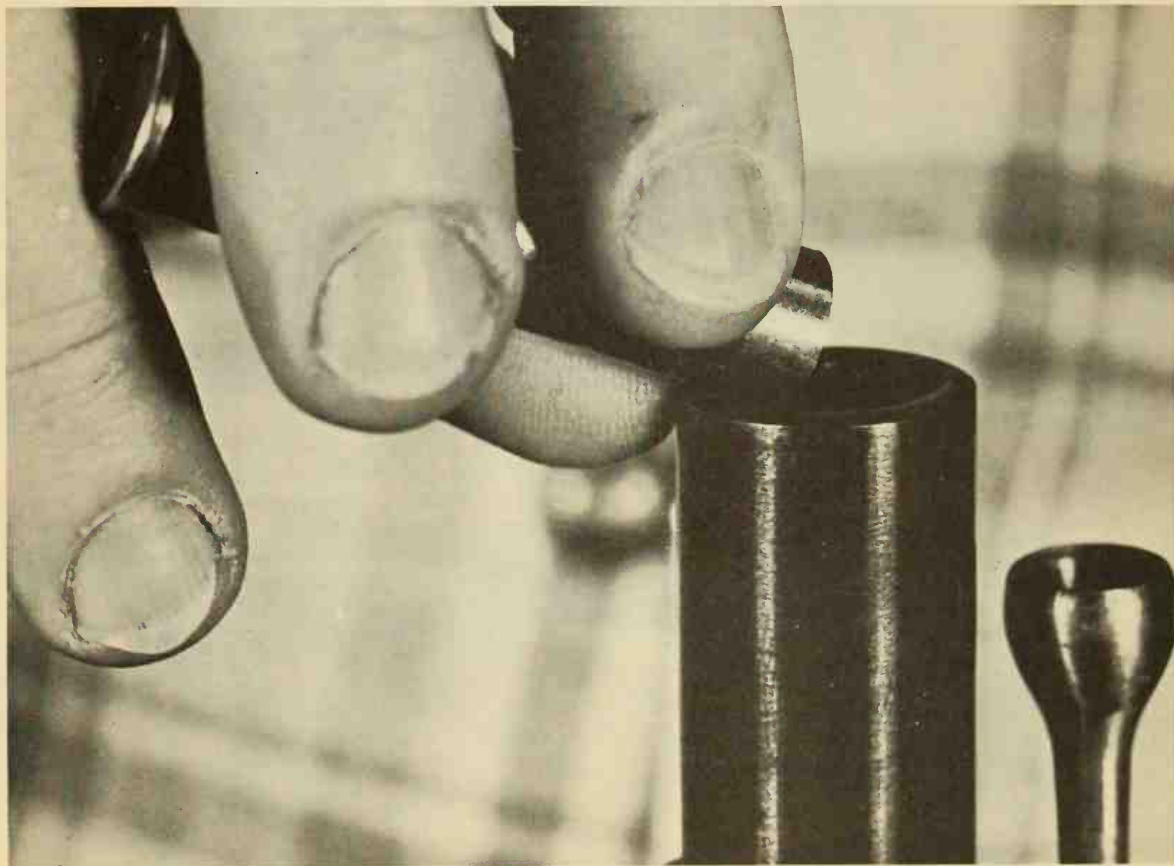
In addition, you should have a nipple prick, nipple wrench, and both worm and cleaning heads for the ramrod (or separate cleaning rod if you prefer) and a charge cup or adjustable measure-flask. These and other accessories serving the same purpose are described fully in another chapter.

Prepare the gun for firing by wiping all oil and grease from the bore with a patch dipped in solvent or lighter fluid. Pour a small amount of solvent into the upright barrel and let it run out through the nipple (hammer at half cock) to clear oil from the vent hole. If solvent doesn't get through, use the nipple prick to get it started. Next, blow through the nipple to dry up any residual solvent. (Doesn't taste very good, does it?)

With the hammer at half cock, place a cap on the nipple. Ear the hammer to full cock and fire the cap making certain the muzzle is pointed down range or in a safe direction. Some smoke should issue from the muzzle, indicating all passages are clear. The cap flame will burn moisture out of the nipple and drum passages. Firing several more caps will make doubly certain everything is clear and is normal practice. Soldiers were regularly issued extra caps for this purpose.

Assuming you'll begin with loose powder and bullet, lower the hammer full upon the nipple. With rifle butt near your feet, lean the muzzle out to arms' length, thus, making certain that any accidental discharge will be directed up and away from you and anyone else in the area.

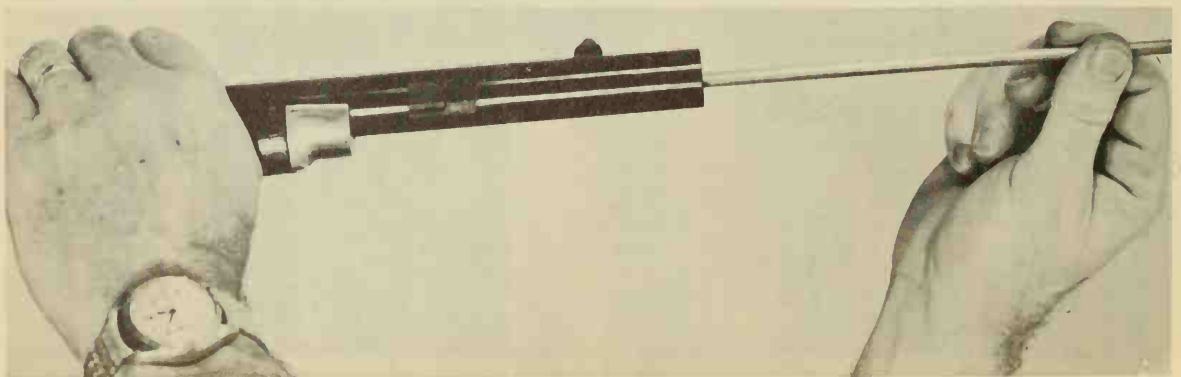
Pour a charge of 50-grains (weight) of powder down into the muzzle. While doing this, avoid placing any part of the hand directly over the bore. If you haven't cleaned all oil and grease out of the bore, it will catch and hold powder. Take the lubricated bullet between thumb and finger and start it base first into the muzzle. Do *not* use the fist or palm to drive in the bullet. Held between thumb and finger as shown, the bullet will not do any damage in the event of an accidental firing while your hand is there. Muzzle flash may scorch your digits a bit, but the bullet will pass safely between them.



Charge Your Piece! After bore is clean and dry and nipple has been cleared, pour the proper powder charge down the muzzle.



Properly greased minie bullet (Lyman's new #57730, weighing 570 grains, here) should be started straight and as far into the muzzle as possible with the fingers. Note that no part hand is actually directly over the muzzle.



Seat bullet with a single, smooth motion of the ramrod. Do not batter the bullet out of shape by banging the rod repeatedly against it, once it makes contact with the powder.

Draw the ramrod from its seat in the stock. Holding it between thumb and forefinger, reverse it and use the cupped end to force the bullet home on the powder. A single, smooth movement ending with the bullet solidly on the powder is best. Bullet should be seated with uniform force, but never ram it really *hard*, and never “bounce” or “throw” the ramrod against the bullet as depicted in some television and movie scenes. To do so will seriously deform the bullet and crush the powder granules resulting in a very inaccurate shot.

After firing several shots — perhaps 15 or 20 — ramming will become difficult. When it reaches the point that the thumb and finger won't do the job, clean the bore — don't start trying to *drive* the bullet down the barrel. This will only deform it and ruin accuracy. A clean barrel and proper size bullets will always produce smooth, easy ramming and best accuracy.

Return the ramrod to its seat, pushing it into place with the tip of a finger so as to avoid passing any part of the hand over the line of the bore. In the case of a rapid-fire match, you'll probably just stick the ramrod upright in the ground at your feet.

Assuming you intend to fire immediately, point the musket down-range, cradled in the left arm (for a right-hander). Ear the hammer back to half cock, making certain the trigger is not even *touched* during the process. Any trigger movement can result in improper engagement of sear in the half-cock notch, setting the stage for just a slight jar of the gun to cause an accidental firing. This precarious engagement is sometimes called “false cock.”

With the hammer properly at half cock, place a cap over the nipple, pressing it solidly home with the ball of the thumb. A capper may be used if desired, but even then, seating should be verified by thumb pressure.

“Ready on the right — ready on the left — ready on the firing line”! Pull the hammer to full cock, aim, finger on trigger — “Commence Firing”! Settle the bull on the front sight, press the trigger, and as that broad butt shoves ponderously back into your shoulder, orange, flame and white smoke blossom from the cavernous muzzle. A 500-grain slug as big as your thumb arcs toward the target, just as thousands of them did on battlefields more than a century ago all over the world.

Simple, wasn't it? Fun, too! No modern, high-velocity, smallbore rifle can quite match the atavistic thrill to be had from the big military charcoal-burners of yesteryear.

Hurry up — load her up again and let's have another go at it!

Stop right there. The infantry private in the line at First Manassas had to hurry loading or take a bayonet in the throat — he *had* to risk things like lousy accuracy, a misfire, or an accidental firing. There wasn't any other way. You don't have that problem — but



In returning the ramrod to its seat in the stock, use the tip of a finger so as to keep all parts of the hand clear of the bullet's path in the event of an accidental discharge.



After the bullet is rammed, seat cap on nipple solidly.



Lyman #575213 minie is of traditional shape with deep conical base hollow, weighs 460 grains. Right is new #57730, 570 grains, with larger cylindrical base cavity, and a good bit more bearing surface for more accurate alignment in bore during ramming and seating.

you *will* have problems if you get in a bodacious hurry for that next shot and do something stupid.

First, if you up-end that musket immediately after firing and dump a fresh powder charge down the barrel, there just *might* be a spark or ember down in there. If so, it *might* ignite the powder with one hell of a bang, perhaps causing the flask, if you're using one, to explode.

There *could* be a half-dead ember in the vent hole. If so, nothing might happen until the bullet is rammed home at which time air being forced out through the hole could fan the spark to ignite the propelling charge. If that happened, both bullet *and* ramrod would be shot out, quite possibly making a mess of your hand or anything else in line with the muzzle. Another reason for careful handling of the ramrod as already described.

This sort of thing is easily prevented. Just don't be in a big rush to reload. Second, before reloading,

lower the hammer full down on the nipple, preferably sandwiching a small piece of leather between the two. This will prevent the rush of air that might fan a near-dead ember to life. Some shooters affix a short leather strap to the hammer for this purpose, swinging it aside for shooting.

So, take your time reloading. In too big a rush, you might even ram a bullet *without* any powder under it. Don't laugh; it's happened to many an experienced shooter, and can be most embarrassing. Another rather interesting result of too much haste occurred to a friend of mine. He hurriedly charged, rammed, capped, and fired to watch in open-mouthed dismay as his three-foot long ramrod sailed end over end toward the target. In the rush, he'd forgotten only one thing — to take the ramrod out of the barrel! Only a *little* mistake, but ?

All this is intended to convince you to take it easy in the beginning.



The final and most enjoyable step is the shooting. Navy Arms .58 caliber Zouave is man's gun and feels really good when it spouts flame, smoke and lead.

Shooting can be safely made faster and more convenient. The first step in this direction is to place pre-measured powder charges in plastic containers to simplify charging. Plastic tubes which are a snug fit on the bullet may be obtained. Powder is placed in the tube which is then "stoppered" with the bullet. In use, one simply plucks the bullet from the tube, pours charge into barrel, and immediately starts bullet in muzzle. North-South Skirmishers often grab the bullet in their teeth and twist the tube off.

Also a considerable convenience is the prepared paper cartridge described in detail elsewhere in this volume. Since its use is fairly well restricted to the rifled musket, we'll dwell on it here at some length.

The envelope or tube contains the powder charge and is tied or cemented securely to the bullet. Either the base may be torn open or the end containing the bullet may be torn off to expose the powder. In either case, the powder is poured down the barrel. Then the bullet and whatever paper remains attached to it is rammed home. The paper may be torn in almost any manner, so long as the powder isn't spilled, but the soldier armed with the rifled front-loader grabbed the bullet in his teeth and ripped away, often spitting the bullet into the muzzle as he reached for his ramrod after pouring in the powder. Or, if he were more fastidious, he might hold the bullet in his hand and bite off the base of the cartridge.

In either case, good teeth were essential. Interestingly enough, the army's rigid dental standards stemmed from this need. Only in the past few years have those old cartridge-biting tooth standards been relaxed.

Paper cartridges of this type are *not* nitrated, so the paper is blown clear of the barrel without being consumed. This increases the possibility of a live ember being left in the bore.

Combustible cartridges may also be used. They, too, are covered in detail in another chapter. This type is inserted whole into the muzzle and rammed as a unit. The tapered nitrated paper case ruptures when rammed solidly, exposing raw powder to the cap's flash. However, even if the nitrated paper blocks off the vent hole, the cap flash will ignite and pierce it to fire the propelling charge. The paper is consumed by the burning powder, but there is still the possibility that an ember will linger in the chamber depths to scare the hell out of you if proper charging precautions aren't taken. Nitrated combustible cartridges are far more fragile than the plain type and must be handled carefully.

The original issue powder charge for the U.S. .58 caliber rifled musket was 60 grains of black powder, fg granulation. It produced 934 fps with the 500-grain minie bullet from the 33" barrel. That load is too hefty for comfortable range work. And, in fact, considerably less accurate than lighter charges. Charges in the vicinity of 50 grains of ffg or fffg usually give much better

accuracy than the issue load, and produce much less recoil as well. Particularly pleasant to shoot is 35-40 grains of fffg which produces excellent accuracy at 50 yards, the range at which most rifled musket competitions are held.

Since individual rifles will behave somewhat differently, the charge should be varied until maximum accuracy is obtained from your particular gun. To be competitive in official North-South Skirmish matches, a gun must be able to group its shots into slightly less than three inches.

While Lyman Bullet 575213 normally shoots quite well in .577 and .58 caliber rifled muskets, it will be well worth your while to try 575213 O.S. (oversize), 575494, and the new 57730. The latter has a very blunt nose, shifting the center of gravity well forward, and has been producing very fine accuracy.

Perhaps we've been remiss here in referring only to .58 caliber guns. Actually, rifled muskets will be encountered in .54 and .69 caliber with some frequency. An occasional European arm of the type will also show up in some other caliber. Procedures are the same with all of them. Smaller calibers work best with less powder, the bigger ones with more. Lyman makes molds suitable for about any bore size you might encounter, so no problems there.

Seldom is much thought given to shooting anything but minie-type bullets in the rifled musket. However, patched round balls can also be used with a fair degree of success. Simply load them as for a conventional round-ball rifle, with ticking patches. Keep powder charges light to start, beginning at about 30-35 grains and working up only to the point where acceptable accuracy is produced. The heavy charges often used in round-ball rifles are a bit much for the relatively thin-walled musket-barrels, so don't try them. Round balls won't do as well as the minie, but they are fun for plinking and short-range work.

Hunting with the rifled musket can be a most rewarding experience. A gun and load tuned to produce the 3" groups at 50 yards already mentioned is easily capable of taking deer and black bear at ranges up to 100 yards — and most of those animals are shot a lot closer than that.

As for power, don't fret. On paper that big minie develops less than 1000 fp of energy at the muzzle. But its performance is much more impressive than that figure suggests. It hits like the flat of an axe swung by a seven-foot Swede. Any deer hit decently with it will either plow dirt with his nose or die of pneumonia from the wind going through that huge hole in his hide.

The rifled musket was all things to all men in war. And, it can be many things to you — serious competition in the skirmish tradition, plinking along the creek bank, or putting winter meat in the smoke-house. It can do them all — just take the time to do your part.

Chapter 6

SHOOTING THE CAPLOCK ROUND BALL RIFLE

Of all the sporting and target muzzle loaders, I'd reckon the round ball caplock rifle is shot more today than any other. Of course, the slug guns have their following, as do the picket ball guns. The scatter gunners have their day as well, along with those optimistic fellows who bang away with smoothbore "rifles," wishing all sorts of projectiles toward the target.

The round ball rifle, hereafter, called simply a rifle, has earned its popularity. As a flintlock, it's the form in which the rifles of Rogers' Rangers, Marion's Swamp Foxes, and similar bands of patriots decimated Redcoat ranks in the forest battles of the American Revolution. It's the gun upon which the trappers and mountain men staked their lives as they explored the vast unknown domain west of the original 13 newly-freed states. It's the gun upon which the golden era of the fabulously wealthy fur trade was built. It's the Kentucky rifle, descended from heavy, stubby Jaeger guns that has generated so much legend of the 18th Century in America.

The rifle comes in many forms. It may be an incredibly slender, .30 or .28 caliber "Pea Rifle" used for small game; a robust .45 or .55 caliber "Plains Rifle" intended for bear and Indians west of the Father of Waters; a light, short "Buggy Rifle" of the settled areas; or even a 20- or 30-pound target rifle intended for showing off one's skill in the peaceful times. Big or little, heavy or light, short or long, playful or deadly serious — the round ball rifle may be any of these. There's one to suit every man's taste, either original guns or those of modern production adhering to the old designs.

Round balls are the easiest of all bullets to cast or buy already made. They require a minimum of lead and are thus economical. They can be bought dirt cheap in many calibers by the bag full, and, as stated elsewhere, these factory-swaged balls will often shoot better than the ones you carefully make yourself. These factors all contribute to the rifle's popularity among today's black powder shooters.

If you don't already have a front-loading rifle for the coming season's activities, start looking. What's

best? Depends on what you want to do. If you plan a journey backward in time that includes a fall elk or bear hunt with round ball, you'll need something on the order of a plains rifle, shooting a ball 40 to 60 to the pound (.49 to .42 caliber) — say, of at least .45 caliber, preferably over .50.

If you simply want to shoot, a slender Kentucky of around .32 or .36 caliber is best.

If you want to do some serious target work, then the thing to get is a heavy target rifle of at least .40 caliber, and, it won't be light enough to take to the field.

Original guns of any type have become too precious and rare to be spoiled by shooting. Money isn't the real problem since many of us spend as much on a custom-built *new* rifle as a fine original is worth. But, once the original is worn out or damaged, the entire supply of a very important historical item is reduced by one — it can never be replaced. The modern gun is easily replaced, without loss to posterity.

So, heed the pleas of collectors and historians, and confine your shooting to modern rifles. There are plenty available, ranging from the Hopkins & Allen .40 or .45 caliber under-striker at about \$75, upward to as much as your want to pay a custom maker. Examples are the Dixie "Plainsman" rifle at \$125, the Dixie Deluxe "Kentucky" at \$165, and others in the \$150-\$200 range. You can even buy parts or kits and build your own, as detailed elsewhere in this volume. That will not only save you money, but add considerably to your education as well.

In any event, get the catalogs of the outfits supplying such guns (listed in the directory at the end of this book) and decide what you want and what you can afford. Get the gun, and then we'll take it from there.

You'll need round balls of the proper size, usually specified by the maker of the gun. The ball should be just under bore (land) diameter. Patching cloth can be unbleached muslin sheeting, or striped bed-ticking, or the more expensive linen, thoroughly washed twice to remove all the sizing. The gun maker will normally

recommend patch material thickness. From there it's just a matter of carrying a micrometer and shopping. When you find some that's right, buy enough for at least a season's shooting — 10 or 12 yards.

Get caps as specified by the gun maker, and a supply of ffg powder. You'll also need a patch knife or patch cutter and patch lubricant.

The usual shooting kit is essential: nipple prick; nipple wrench; screwdrivers; worm; cleaning supplies; powder horn, flask, or measure; etc. This outfit is described in detail elsewhere and is pretty much the same for use with any muzzle-loading arm.

With all the gear together, maybe you're beginning to wonder just what kind of ballistic performance can be gotten from the rifle. Probably better than you think.

The round ball rifle drives its bullet faster than any other muzzle loader, and uses considerable powder to do so. A Hawken .52 or .53 caliber might well consider 200 grains of ffg or ffg powder a perfectly normal full-charge diet. A .40 caliber rifle with 40" barrel can produce well over 2400 fps with its 95-97 grain patched ball, using 120 grains of ffg powder. I've set up a chronograph at matches and recorded velocities even higher from small-bore, long-barreled rifles charged to the hilt. Extensive velocity tests have been conducted with Hopkins & Allen (Numrich Arms) under-striker rifles of modern manufacture. The results are contained in the appendices of this volume, and reading them can be a revelation to those who think in terms of "low-velocity" muzzle loaders. Even the 20" barrel produced over 1400 fps with a light powder charge, nearly 2000 fps with a full charge.

Of course, since the round ball is a very poor ballistic shape, it loses velocity at a very rapid rate. Trajectory is likewise very high when compared to that of conical projectiles of the same diameter. Even so, there are many contemporary accounts of men and game being killed consistently at ranges of over 200 yards in the late 18th Century. During the Revolution, Tim Murphy is credited with a single-shot kill on a British officer at over 300 yards.

You don't have to load for maximum velocity. In fact, accuracy will often suffer if you do, just as in modern, smokeless powder breech loaders. Shoot for comfort and accuracy, not just speed and noise. After all, this is a "fun" game.

On the range with all your gear, start by wiping the bore clean and dry, and clearing the nipple by firing a cap or two. Set the hammer down on the nipple, preferably with a piece of leather between the two, and prepare to charge with powder.

How much powder? The old timers had rules to go by, and the one most often cited consisted of placing the ball in the palm of the hand and pouring out enough powder to cover it. Once this was done for a new rifle, a cup-type measure of horn or similar material was made to hold that much powder. Actual weight

of the charge didn't really matter. It was results that counted, and the average rifleman couldn't tell you what his charge weighed. In "The Muzzle Loading Cap Lock Rifle," Roberts states this method results in the following average charges.

	<u>powder</u>
.31 cal. (150 per lb.) — (47 gr. ball) —	25 grains
.36 cal. (100 per lb.) — (70 gr. ball) —	40 grains
.44 cal. (56 per lb.) — (116 gr. ball) —	60 grains
.60 cal. (18 per lb.) — (388 gr. ball) —	85 grains

You can easily interpolate between these four examples for other calibers. The charges given are moderate, far from maximum, and all that you need in the beginning. Additional "standard" charges for all types of guns are found in appendix.

With further shooting, you'll develop a charge that performs best with your particular rifle and ball/patch combination and can then make up a charger or measure a supply of the starting charge into plastic bottles.

Pour the powder into the barrel. Moisten a corner of a piece of patching cloth thoroughly with saliva, lay it across the muzzle, and center a smooth ball in the muzzle. Make certain the sprue is uppermost and centered, and then press the ball into the muzzle as far as possible with your thumb.

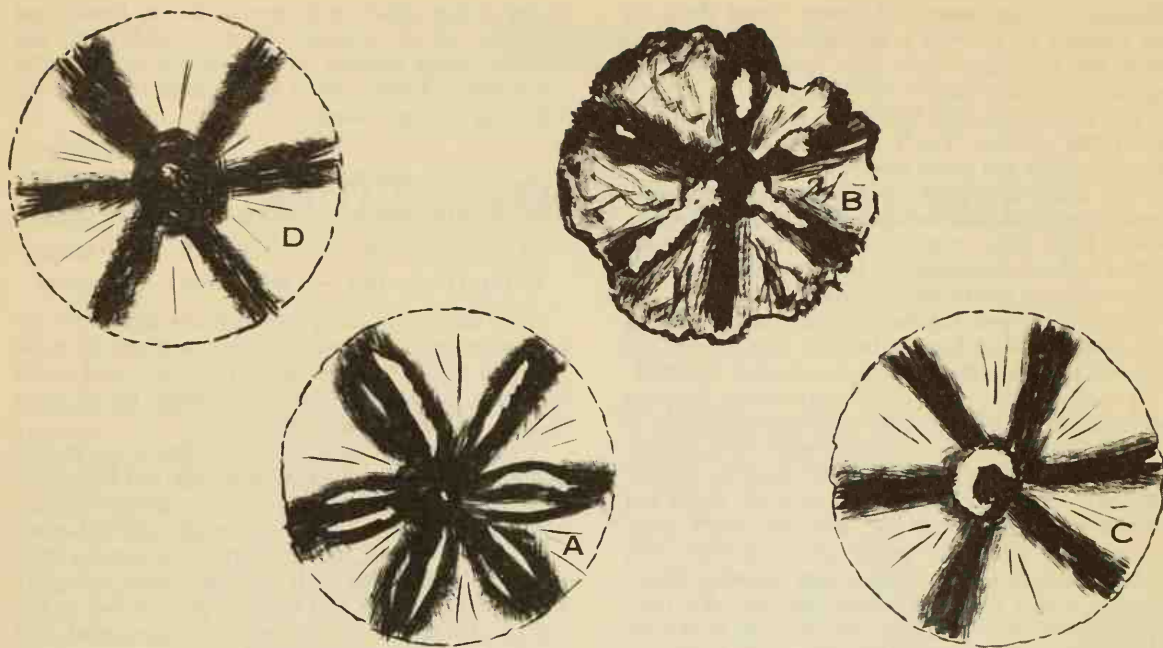
Take the short ball starter and with a single blow of the heel of the hand, seat the ball the depth of the short leg of the starter. Take your patch knife and while gathering up all excess patching with the other hand trim the patch flush with the muzzle. This must be done cleanly and the knife must be very sharp. A ragged trimming job will reduce accuracy. Next, repeat the starting operation with the *long* leg of the starter.

Take the ramrod, seat it on the ball, and with a single, smooth motion, thrust the ball down firmly on the powder. Don't pound the ball or bounce the ramrod. The ball should be seated tightly enough to compress the powder only slightly. More pressure will deform the ball and interfere with uniform powder ignition.

Withdraw the ramrod. No, that piece of instruction isn't superfluous. Many a man, including the old timer who lived by his front-loader, has shot out his ramrod. Loading routine should become so fixed in one's mind that no matter what interruptions occur, the proper steps will *all* be taken.

Ear back the hammer to half cock and place a cap on the nipple.

Cock and shoot! Best do all your first work with a new gun from bench rest. Lacking a *solid* bench, use a bedroll or roll of blankets and shoot from the prone position. In checking accuracy initially, don't hesitate to get a local expert to shoot for you if you lack the requisite skill.



Recovered patches should look as in "D". "A" means fit in bore is too tight; "B" too loose; and "C" muzzle has cut through patch in loading.

Assuming the ball went on the paper, proceed to shoot a 10-shot group. Load the second and subsequent rounds exactly as the first. The more uniform your balls, patching, and the loading operations, the better the accuracy that will be produced. Observe all the loading precautions outlined in the chapter on the rifled musket. Powder charges *have* been ignited by an ember as they were poured down the barrel. Bullets and ramrods *have* been fired right through the shooter's hand during loading. Like driving a car, muzzle-loading shooting is as safe as you, the shooter, makes it — for both you and nearby parties.

As shooting progresses, watch the pressure required to ram the ball. If it increases significantly, the bore is becoming too heavily fouled and needs cleaning.

Look out in front of the muzzle a few yards for patches that have fallen off balls. All *must* fall off, or the ball's flight will be erratic. Inspect recovered patches carefully. The accompanying drawing shows clearly what to look for. Patches cut as in "a" indicate either too-thick patch material or too large a ball so tight in the bore that the lands cut through the fabric. If the patch is scorched by blow-by gas (windage) as in "b," patch is too thin or ball is too small. Annular cuts as in "c" are made by the sharp bore edge at the muzzle. If not accompanied by other cuts as in "a," the muzzle edge is too sharp and should be lightly

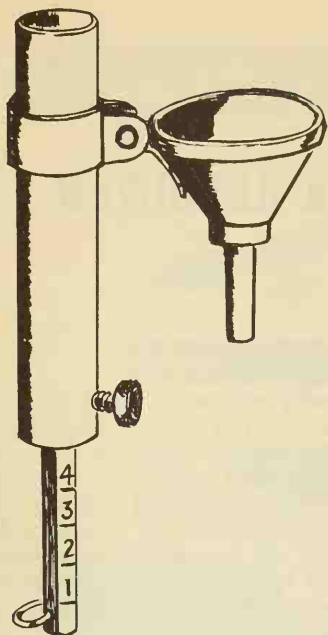
chamfered. This is best done in a lathe, but with care a 45-degree countersink reamer will do an entirely acceptable job.

Any of these patch conditions mean you'll get lousy accuracy, so correct them as quickly as possible. Patches should look as in "d" when they are recovered.

After obtaining groups of consistently the same size (no matter how large that might be) it's time to tune rifle and load for best accuracy. First, if group No. 2 is larger than group No. 1, No. 3 larger than No. 2, and so on — fouling is your problem. A very slightly larger ball or thicker patch may help by doing a better job of pushing the fouling to the breech during ramming.

Or, it may be that your new barrel isn't smooth enough. A rough surface may not wipe clean, even with a tight patch. In that case, it may be lapped or polished as outlined elsewhere. Thorough cleaning after each group may well cure this problem also. Having checked the foregoing, proceed to varying the powder charge. Work upward first, going in increments of two or three grains. Top limit for thick barrels is powder weight equal to ball weight, but best accuracy is almost invariably found below that level. Don't expect a single group to tell you much at each charge level. At least five are necessary for a valid test.

If heavier charges aren't the answer, work down-



Especially handy when working up a load or varying powder charges is this simple, adjustable powder measure and loading funnel combined. By recording the settings, a single measure like this can be reset for use with more than one gun.

ward in the same fashion from the starting charge. Don't expect to find the best charge in a single range session. In all probability, several hundred rounds will be fired just in determining this one factor.

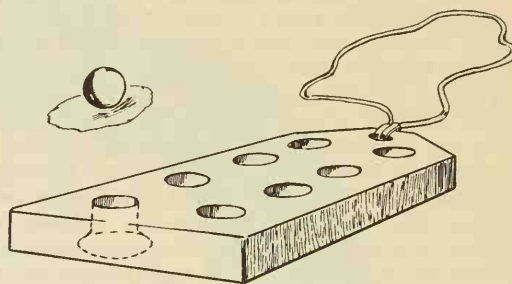
Having ironed out these first problems, you might then try changing to a greased patch. It may produce better accuracy than a wet patch. For hunting, you'll want to use greased patches anyway to prevent rusting of the barrel. All manner of lubricants have been used on patches. Tallow was once popular, as was sperm oil and bear oil. I've used both petroleum jelly (Vaseline) and vegetable shortening (Crisco) with good results. Some shooters soften bees-wax with Vaseline and dip patches in this melted mixture. If you're striving for perfection, try them all.

In striving for maximum accuracy, remember that you'll never know the cause of the effect if you vary more than one factor at a time. If switching to a thicker patch, don't change anything else, and so on.

You may find that accuracy improves unaccountably over a period of time. This can happen as a result of the bore being slowly but surely polished by each shot. Conversely, if through neglect you allow the bore to become rust-pitted (no matter how slightly), accuracy may deteriorate.

Slow and careful shooting with plenty of attention to cause and effect will enable you to extract all the accuracy possible from your round ball rifle.

Eventually, though, you'll want some plain fun shooting, maybe even some hunting, and probably some competition. Where speed in reloading is required, a loading block is essential. It's simply a block of hardwood with a row of three or four holes drilled in it. The holes are a snug fit for a patched ball and balls are seated in it exactly as in the rifle muzzle. Attached to the block by a thong is a starter with stem long enough to push the ball through the block and into the bore where the ramrod can take over. The block is placed over the muzzle and the ready-patched ball is seated in much less time than otherwise. Since the ball must be centered over the bore, a muzzle-fitting counterbore in the bottom of the block around each hole is a decided improvement.



A simple loading block whittled out of a piece of scrap lumber greatly simplifies reloading in a hurry. It's almost a must for hunting.

When hunting, and rain or moisture is a problem, drip melted bees-wax or candle around the seated cap to keep water from working in through the vent to kill the powder charge.

So far, we've talked only about the sporting round ball rifle. There are, however, quite a few shooters who fancy this type in bench rest form — heavy guns not suited for any other purpose. The basic rules are the same, with added emphasis on uniformity of loading and of components. Such guns are more temperamental and careful load development is required. These guns are fitted with false muzzles and mechanical ball starters. Essentially, they must be treated as outlined in the chapter on slug rifles, allowing for the difference in bullet type and patching material and method.

Round ball heavy target rifles are capable of superb accuracy, significantly better than hunting rifles. They are, though, a lot more trouble to shoot, and significantly more costly.

Aside from plinking and shooting on the range, the round ball rifle is the basis of nearly all of those shooting games muzzle-loading fans talk about — the woods walk; the rendezvous; the famous "Seneca" match; the squirrel hunt; and many others. It's the real backbone of the whole game and can open up a whole new world of fun for you.

Chapter 7

SHOOTING THE CAPLOCK REVOLVER

Whether it be an atavistic urge to emulate our great grandfathers or simply a desire to try a different form of shooting, the muzzle-loading, black-powder percussion handgun enjoys greater sales and popularity today than at any time since the advent of the cartridge handgun. Original arms of this type are by no means scarce, but in anything like safe shooting condition, they come very dear, indeed. The tremendous up surge in collecting percussion revolvers has driven prices out of sight of the casual shooter. Then, too, shooting an original Colt or Remington will cause some mechanical deterioration, accompanied by a similar depreciation in value. The answer is quite simple — just don't shoot original percussion revolvers. There's no need to, really, for a new modern percussion revolver can be had for a quarter or less of the price of a shootable original — and it will shoot better as well.

To use the word "modern" in describing today's percussion handguns is perhaps not entirely correct. A large assortment of newly-manufactured guns is available. Though manufacture and materials are modern, design is little (if at all) changed from American Civil War days. Reproductions of Remington and Colt revolvers, circa 1860, are sold under a number of brand names, including Navy Arms Company, Centennial Arms Corporation, and Replica Arms, to name the principal suppliers. Centennial guns are produced in Belgium by a firm that once manufactured the same design under Colt license. Both Replica and Navy guns are manufactured in Italy. In addition, single-shot pistols — an underhammer "boot" pistol from Numrich — are offered by Numrich Arms, Tingle, and Replica.

The safety margin of the imported replica revolvers is undoubtedly greater than that of the originals. I have yet to encounter a single instance of a "blow-up" that could be traced to defective materials when only black powder was used. While current production guns lack the fine finish and bright blue of the original models, they appear to be produced to closer tolerances, and are certainly made from better materials than were available in the 1860's. Consequently, so long as only

black powder and proper bullets are utilized, modern percussion revolvers are as mechanically safe as a gun can be. In fact, it is impossible to generate excessive pressures with any amount of black powder than can be loaded into the individual chambers behind a proper bullet. In the discussion of shooting techniques which follows, we will concentrate on revolvers. Single-shot pistols are less complicated, and require techniques closely approaching those used with rifles, so will be covered elsewhere.

Caplock handguns are available from a number of sources. Navy Arms Co. offers replicas of the Colt and Remington revolvers. Both are available in either .36 or .44 calibers. Centennial Arms features replicas of the Colt 1860. Replica Arms has the Remington and a most complete line of Colt revolvers — from the Paterson, Walker, and the 1860 Army, down to the diminutive Wells Fargo. They also offer a single-shot target pistol. Numrich Arms offers their Hopkins & Allen Boot Pistol in .36 or .45 caliber. Tingle makes a single-shot target pistol. Dixie Gun Works has a low priced "Navy" revolver and several models of single-shot caplock pistols. Incidentally, the Dixie catalog (\$1) is a treasure chest of black powder shooting information. It should be a must for every black powder shooter. In addition to these, several other firms offer single-shot caplock pistols, including Intercontinental Arms, Richland Arms, etc. All are listed in the directory section of this book.

Accessories are generally available from any of the above, including round ball moulds, caps, powder flasks, etc. In addition, Alcan offers swaged .44 caliber balls, ready to shoot. The Lyman Gun Sight Co. offers their popular moulds in round ball sizes to fit every black powder caliber.

In the revolvers, the Colt design with its open-top frame and wedge-fastened barrel is quite simple to dismount for cleaning. This is absolutely essential after every shooting session. The Remington design with its solid frame completely encircling the cylinder, and its screwed-in barrel is inherently a stronger design than the other; it also has far fewer screws and parts to



The open-top Colt design of percussion revolver is the easiest to disassemble for cleaning, thus, the least likely to be neglected.



The Remington design, exemplified by this ornately engraved Navy Arms "Belt Pistol" is the sturdiest and best suited of modern percussion revolvers to the fitting of adjustable target-type sights.

become lost or damaged. Both are entirely satisfactory, and aside from sights, a choice between the two must be made on the basis of personal preference. The Remington is far more suited to sight improvement and fitting of modern target sights.

Unless you are completely familiar with single-action revolver mechanisms, the newly-purchased gun should be completely disassembled and studied until you know it well enough to tear it down and put it back together properly with a minimum of effort. This can be combined with an initial disassembly and cleaning of the gun to remove all preservative grease before the first shooting session.

Wash all the component parts in non-flammable solvent or in gasoline, if nothing else is available. If the latter, be certain you do it outdoors.

During reassembly, coat the base pin (upon which the cylinder revolves) liberally with heavy grease. Apply a good grade of gun oil to all pivoting and sliding parts, and some good lubricant at sear notch, main-spring bearing, and bolt cam. A drop of oil on each screw will also facilitate later disassembly. If you want to be real classy, use molybdenum disulphide base grease. If shooting is to commence within a day or two, do not oil or grease the inside of the chambers or the nipples.

In shooting the cap lock muzzle-loading revolver, all normal firearms safety precautions *must* be observed, and, in addition, others are required. These will be pointed out as we go along.

To prepare for shooting, assemble the following items and materials: can of fffg black powder; caps of proper size to fit nipples of your particular gun (No. 11 fits some, but is a bit too large for others, which require No. 10); pure lead round balls, which may either be case or swaged (.44's require .452" balls, .36's, .375", and .31's .320"); a small tin or wide-mouthed bottle of soft grease or kitchen shortening such as Crisco; a powder flask with spout of proper size to throw the correct charge for your particular gun, or a charge cup. A .38 Special fired case works well in .44 caliber, the same case shortened 1/4" in .36 caliber.

For a trouble-shooting kit, you might add a nipple prick; a nipple wrench; screwdrivers to fit all screws; and a cleaning rod and patches, preferably a slotted-tip rod. And, if you don't want your wife objecting too loudly to dirty clothing, a wiping cloth, and, if you are truly fastidious, a canvas carpenter's apron.

Swab all oil and grease out of the individual chambers with solvent, and allow some to run through the nipples, clearing grease from them. Wipe the bore out also. These functions can be performed before leaving home.

To make absolutely certain the nipples are clear and the gun will fire, it is standard practice to explode a cap on each nipple before loading. Personally, I make

it a practice to explode two caps on each nipple. Set the hammer at half cock and make certain the cylinder rotates freely. Turn the cylinder by hand so a nipple lines up with the capping cut in the right side of the recoil shield. With your thumb, press a cap firmly on the nipple. This is most easily done by holding the gun on its left side, muzzle angled downward, then thumbing the cap firmly onto the nipple. The cap should be snug enough on the nipple that it cannot be shaken off if the gun is held vertically. Yet, it must not be so tight that any great effort is required to force it on, or that it stretches or splits in being seated. The cap must go fully down on the nipple and not drag against the face of the recoil shield as the cylinder is rotated. Never let the muzzle point at your own body, or anyone else, during this operation.



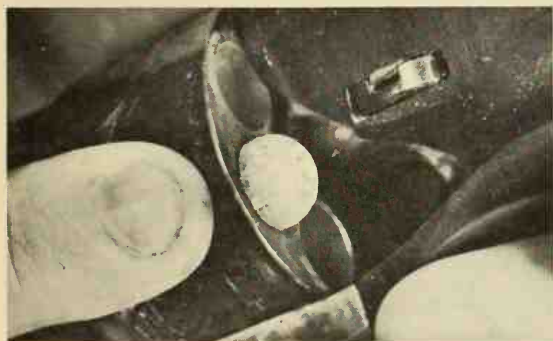
Caps must be seated snugly and firmly on the nipples. Cap shown here is not fully seated and must be pushed down until it rests solidly on the nipple face. Use correct size or cap will either split in seating, or fall off.

All six nipples should be capped in this fashion, then the hammer drawn to full cock and each cap exploded. Smoke issuing out the barrel as the cap explodes indicates the nipple vent or flashhole is clear. If no smoke issues, check that particular nipple by running the nipple prick through it, or looking through it at the sky to make sure light can be seen. Most of the time, firing a second cap will clear a clogged nipple.

To load, make certain no unfired caps are inadvertently left on the nipples. Set hammer at half cock. Hold the gun muzzle up, right side toward you and, with charge cup or flask, pour the proper amount of powder into the chamber nearest the loading cutout. Take a ball and seat it on the mouth of the chamber. It will be large enough that it will not enter. If cast balls are used, orient them carefully so the sprue cut is upward and centered. Now, rotate the cylinder so that the ball comes directly under the rammer plunger. Unlatch the rammer lever and with smooth, even



Gun should be held muzzle-up and powder charge carefully poured into chamber. A charge cup is adequate, but a flask is more convenient and rapid.



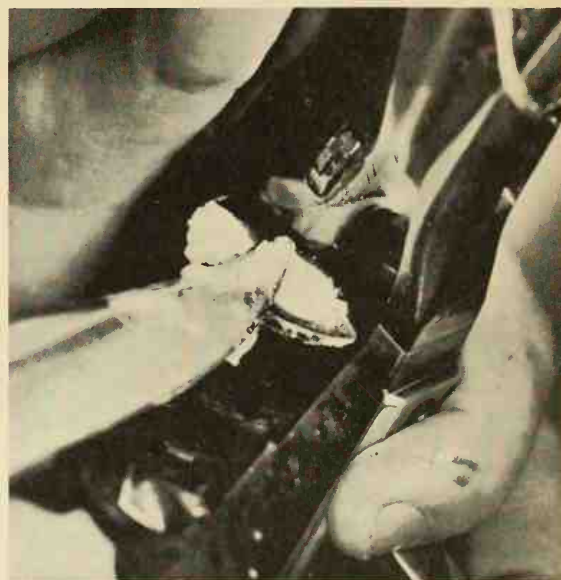
After each chamber is charged, carefully center ball in chamber mouth with sprue upwards, and then seat with a single, smooth stroke of the rammer lever. Don't crush powder excessively, and don't leave space between ball and powder. Ball snug on powder works best.



When ball diameter is correctly matched to chamber, a thin ring of lead will be sheared off as the ball is seated.

pressure, seat the ball firmly on the powder. A thin ring of lead will normally be sheared off by the mouth of the chamber, and the ball can be felt grating against the powder as it seats. Use just enough pressure to compact the powder slightly and to seat the ball at least $1/16$ " below the chamber mouth. Too much pressure will deform the ball and ruin accuracy. Continue placing powder and ball in the remaining chambers, striving for uniformity of powder charge and of ball seating pressure. For informal or competitive shooting, only five chambers are normally loaded. The hammer is rested on the nipple of the unloaded chamber.

Get out your grease or shortening, and use it to fill the chamber over and around each ball using a knife blade or wood spatula to keep the mess off your hands. The grease should fill the chamber flush with its mouth.



The old timers had trouble with multiple discharges when flame from one shot ignited powder in adjacent chambers. Filling mouth of chamber over ball with grease or shortening prevents this and also serves to keep powder fouling soft and easily removed. Helps prevent bore leading, too.

Grease thus applied serves two purposes. It prevents flame from the chamber being fired from flashing over and firing adjoining charges. Though this possibility may seem remote, it can happen if an effective means is not used to seal each chamber. The grease also serves to lubricate the bore and ball and keep the abundant black powder fouling moist and soft. If kept moist, fouling from each shot will be wiped out by the next, increasing the number of rounds that can be fired between cleanings.

If applying grease in this fashion is too messy to suit your taste, use grease-soaked felt wads under the ball instead. Prepare them by cutting wads about 1/32" larger in diameter than the chamber, then soaking them in melted grease or tallow. Place one in each chamber, over the powder and seat the ball on top of it. With powder, ball, and grease in place, cap each nipple as outlined before. Unless shooting is to begin immediately, carefully set the hammer down so that the small safety pins protruding from the cylinder between nipples of Colt-type guns enter the slot on the hammer face. If your gun lacks these pins, or the pins will not prevent inadvertent cylinder rotation, then your only safe choice is to leave a chamber unloaded and let the hammer down on its nipple. Personally, I prefer the Remington-type gun here because of the deep safety notches between nipples. The hammer nose is lowered into these notches and is made more secure than by pins. If, at the time you are loading, you know that firing will not take place immediately, simply do not cap the nipples until you are ready to shoot.

Actual shooting of the caplock revolver is no different than that of any other single-action handgun. Pull the hammer to full cock, align the sights carefully, and then hold and squeeze. Sights on these modern guns are copied directly from the original. Consequently, they are not particularly conducive to fine shooting. Certainly they handicap the inherent accuracy of a properly loaded gun. Considerable improvement can be achieved on the Remington-type guns by filing rear sight notch to a neat, square form, after which a flat-face blade can be attached in lieu of the original front sight. The Colt-type guns present another problem, in that the original sight is simply a very small V-notch in the hammer nose. Deepening and widening this notch will help some, but the sideplay in the hammer limits accuracy.

Modern, adjustable target sights may be fitted to any one of the reproduction caplocks, but this is properly outside the sphere of this dissertation. Personally, I prefer to shoot these guns with the original sights. This may handicap my scores, but it does not in the least reduce the immense pleasure I receive from the shooting.

If your caplock has been properly prepared — chambers free of grease and nipples properly cleared — and properly loaded, misfires will be conspicuous by their absence. However, as fouling builds up from successive firing, you will probably eventually pull the trigger to be greeted only by the slight "crack" of the cap — the charge and bullet remaining right where you loaded them.

When that happens, more often than not exploding a second or third cap on the offending chamber will ignite the charge. If it does not, further measures are in order.

Take the nipple prick and thrust it through the

vent into the main charge. Wiggle it around to make certain that the passage is completely free into the chamber and that some loosening of the powder has taken place. Then, holding the gun muzzle down, dribble fine granules of powder into the vent. Fill the vent full, but do not attempt to tamp the powder down. Place a fresh cap on the nipple and attempt to fire. In my own experience, this action has fired the charge just about every time.

If it does not, remove the cylinder from the gun and use your nipple wrench to unscrew the nipple. Clean it thoroughly and set it aside. Take your nipple prick and work through the nipple hole to break up and remove a portion of the rear of the powder charge. Pour fresh powder into the base of the nipple hole, and reinstall the nipple. Fill the vent with powder granules as outlined above, then replace the cylinder, cap, and fire. I have yet to encounter an instance where this action would not clear the chamber. However, should you be so unfortunate as to have a misfire that does not respond to these treatments, simply ignore that chamber until you get home. Once there, drill a small hole into the ball, then turn a woodscrew into it and drag it out by brute force. If you are shooting a single shot, you'll have to remove the ball in the field. A worm on the ramrod becomes essential then.

One other malfunction may occur, though rarely. If only a small portion of the powder charge burns, perhaps due to the balance of it being contaminated by oil or grease, the ball *may* come to rest somewhere inside the barrel. By far the safest way to remove the ball is with a stiff cleaning rod. My shooting kit contains a dowel as large as can be accommodated by the bore and this is used to force the ball out from the muzzle after removing the cylinder. In Colt-type guns, the barrel is usually removed and the ball forced out from the rear. Never try to remove a stuck ball by shooting. More likely than not, any such attempt will at least result in a ringed or bulged barrel.

Normally, a properly loaded gun may be fired for many cylinders-full before becoming too fouled for proper functioning. However, if you anticipate a great deal of shooting, it is a good idea to carry cleaning gear along to the range. Complete disassembly and cleaning isn't usually necessary to restore reliability. Remove barrel and cylinder (cylinder only in the case of Remington types) and wipe all exposed surfaces free of fouling and/or unburned powder. Swab the barrel with a wet bristle brush until clean, and then dry with clean patches. Clean the chambers in the same way, taking special care to get all fouling out of the nipples. Put a little fresh grease on the base pin if necessary, wipe the rest down with an oily cloth, and reassemble. The gun will again be ready to go.

Except in extremely arid climates, black powder fouling may promote rust in a matter of hours. The higher the humidity, the quicker rust will develop.

Because of this, the gun should always be cleaned almost immediately. There are solutions offered for sale which are alleged to prevent rusting if sluiced liberally over all fouled areas. This may well be true, but if you are too lazy to clean the gun the same day you shoot it, you deserve all the rust you get.

Cleaning must be complete and thorough. Completely disassemble the gun, putting all pins, screws, and small parts in a wide-mouth container several inches deep. I find a pint Mason jar ideal. Wipe off the grips (stocks) and set them aside. Put all other parts in a basin of hot water, add any good detergent, and scrub off all fouling. Take particular care with the bore, chambers, nipples, and frame recesses. Put a small amount of detergent into the small-parts jar, fill it half full of hot water, put on a lid, and shake vigorously a few times. Remove lid and run in hot tap water until all residue and suds are gone.

Rinse all parts in the hottest water you've got. Drain by dumping the parts into a large metal colander or strainer, and then set the whole thing in the kitchen oven with the temperature control set at about 200-250 degrees F. Most water will evaporate quickly from the heat of the parts, however, there will be pockets and screwholes that remain wet for hours unless given the oven treatment. Given 20 or 30 minutes in the oven, all metal will be absolutely dry. Then, while parts are still hot, spray with your favorite gun oil. When cool, wipe and reassemble.

This method of cleaning takes far less time and effort than one might imagine. I do not find it inconvenient nor particularly demanding — it absolutely guarantees that no rust will develop for many weeks, even though the gun be completely ignored in the meantime.

So much for the bare mechanics of loading and shooting. But there are other factors to consider. First, the question of bullets. The round ball has proven in most instances to provide better accuracy than the conical bullet. Conical bullets were supplied in the prepared cartridges used during percussion days, and essentially the same forms (and moulds for them) are available today. I suspect that their relatively poor accuracy is due primarily to the fact that because of their shape they are often canted in seating and that they are likely to enter the bore at somewhat of an angle. The spherical bullet, on the other hand, is relatively free of this trouble. Pure lead bullets have always given better accuracy than those made from harder alloys.

Cast balls are often carefully trimmed so the sprue matches the curvature of the surrounding area. So long as the sprue is centered as described earlier, I cannot see that such careful pruning serves any useful purpose. It has been recommended that balls be rolled between glass or steel plates to improve accuracy. I've not found this necessary, or even desirable. In fact, it

can actually cause wide variation in diameter and roundness.

Swaged lead balls are available in .44 caliber (.452" dia.), and the various sizes of swaged buckshot serve for the smaller bores.

These balls look rough — they have been tumbled loosely together in packaging and shipping and are coated with graphite. They don't *look* as if they would shoot as well as a smooth gleaming cast ball. However, they run more uniform in diameter, weight, and density than the *average* cast ball. Not only does their use eliminate the job of casting, which can be irritating and time consuming, but in my experience, they generally produce slightly better accuracy.

The matter of powder charge is always good for an argument. Quite light charges are preferred by many for target shooting to 25 yards, with a heavier charge used beyond that range. The full charge for which the gun was originally designed is seldom used except for hunting or "showing off." Taking averages of the guns in my rack, full charges with hound ball are generally 27 grains in .36, and 38 in .44. The accompanying table shows the velocities produced by these charges.

BLACK POWDER LOADS AND BALLISTICS

Caliber	Bullet	Granulation	Charge	Velocity	Remarks
.36	RB	FFFG	25 gr.	1005 fps	Full Charge
.36	RB	FFFG	16 gr.	—	Target
.36	CB	FFFG	15 gr.	700 fps	Full Charge
.36	CB	FFFG	12 gr.	—	Plinking
.44	RB	FFFG	38 gr.	990 fps	Full Charge
.44	RB	FFFG	22 gr.	—	Target
.44	CB	FFFG	26 gr.	820 fps	Full Charge
.44	CB	FFFG	18 gr.	—	Plinking
.44	#454424	FFFG	30 gr.	800 fps	Full Charge

ALL LOADS WITH FRESH POWDER AND CRISCO OVER BULLET.

For paper punching and general plinking at ranges up to 25 yards, I have found 10 grains best in .31 caliber, 16 in .36, and 22 in .44.

Lesser charges have been recommended by some, however, I do not like to shove the ball too deeply into the chamber. Most chambers are not particularly smoothly bored and the ball suffers additional mutilation in being shoved deeply into them. Also, the deeper the ball is seated in the chamber the farther it must travel before engaging the rifling. Long travel here is not particularly conducive to best accuracy. Deeply seated balls also make it difficult to apply grease properly except by filling the chamber to its mouth. And half a chamber of grease makes for messy shooting.

Some shooters also prefer to use different powder granulations in different calibers. One shooter of my acquaintance insists on ffg in his .36's, and loads the big .44's with ffg. For years I have used ffg in all

calibers, and can see no improvement with the other granulations.

A powder flask with spout filed to correct length to throw the desired charge is the simplest method of getting powder into the chambers. Some shooters who are particularly concerned with maximum uniformity of powder charge carry adjustable volumetric measures to the range. Others pre-measure or pre-weigh charges at home and carry them to the range in small plastic or glass vials. I have found that by careful and uniform use of a flask I can throw charges that vary no more than one grain. Charges carefully weighed to plus or minus 0.2 grains have not produced any measurable increase in accuracy. Therefore, I see no point in complicating a pleasant pastime with additional accessories and work.

If there is small game or varmints within several hundred miles, you'll eventually want to use your front-loading revolver on them. Because of the conditions encountered, especially rain and snow, loading for the field requires a somewhat different technique than for paper punching. In spite of the claims made for it in its hey-day, the percussion ignition system is far from waterproof. If you're hunting in Arizona, this may not be of any concern to you, but where I live showers come up fast. Though the caps themselves are waterproof, we need a way of waterproofing the joint between cap and nipple—otherwise water can seep in under the cap and through the vent to kill the main powder charge. The old timers sealed this gap by rubbing beeswax or tallow over it after seating the caps. That method works, but is difficult to seal the area between the nipple and the bottom of its cutout in the cylinder. I have found it far simpler to first make certain the area is dry, then run melted beeswax completely around the nipple. Melted candle wax should serve just as well.

The grease applied around the balls for target shooting will also keep moisture out, but it collects dirt and debris and will also run in hot weather, making a mess of holster or pocket. It will also come out in big gobs from the impact when you jump off a cut-bank or across a creek. The best solution is a greased felt wad under the ball, combined with melted wax around the ball to further seal any gaps.

Carefully loaded in the above manner, a percussion revolver can be carried for hours in the rain, even immersed in water, and still fire reliably.

If you are expecting damp weather and want to get more than five or six shots off before coming home again, invest in a spare cylinder or two. Load the spares in exactly the same manner as above, and then place each in its own small cloth or leather bag and carry them in separate pockets. If two are in the same pocket and bang together, there is the possibility of rupturing the wax seal around the nipples, or even firing a cap and shooting yourself. Cylinder changes are made quickly and easily on the Remington-type, though the Colt-type requires the butt of your knife or some similar instrument to tap the wedge loose, and the use of the loading lever bearing on the cylinder between chambers to jack the barrel free of the base pin.

Once you've become familiar with the caplock, black-powder revolver, you'll have a new respect for it. Properly loaded and cared for it is both powerful and accurate. With a little attention to detail, it is also extremely reliable under severe weather conditions. With a pair of them riding loaded in saddle or belt holsters, the cavalryman of the 1860's wasn't too badly off — he had 10 or 12 powerful, accurate shots that could be delivered as fast as with today's finest single-action revolver. His sustained fire power may not have been much by today's standards, but for the first round of the festivities he was a formidable opponent.



Chapter 8

SHOOTING THE SLUG GUN

In every field, there is one particular item or piece of equipment that has a reputation for producing the finest results, yet being the most temperamental and hard to please. Its brothers do a good job, but it does the same thing infinitely better — albeit requiring as much babying as a virgin bride.

In our game, the Slug Gun is the one we're talking about. It's the Ferarri of the muzzle-loading clan.

If the slug gun has one outstanding physical characteristic, it is size and attendant weight. A middlin' slug gun will have a barrel well over an inch in diameter and will weigh close to 20 pounds. A *big* one will have a barrel as big around as your wrist, and go as much as 40 pounds. Some guns top that considerably and 50- to 60-pounders aren't particularly rare.

Slug gun bullets aren't small, either. A .50 isn't uncommon, and those big slugs may weigh up to an ounce and a half. The average .45 caliber slug will go 500-510 grains.

The heart of the slug gun is its massive barrel and carefully-mated false muzzle. While original guns are normally finely finished all over, the modern tube may be (and often is) externally only a roughly-planed octagon without any polish or finish. The boys spend their money on performance, not looks. Inside, it's another matter. The bore is most meticulously rifled and polished to produce a glass-smooth surface and just the right amount of choke (inward taper) toward the muzzle. In all likelihood, the false muzzle will have been cut from the same steel bar and carefully fitted and doweled in place before final reaming and rifling. This is to insure that lands and grooves of barrel and false muzzle are in absolutely perfect register. One of the characteristics of the slug gun is the perfection with which the bullet must be engraved (forced into the rifling) and centered in the bore during muzzle loading. The perfectly-aligned false muzzle is essential to this.

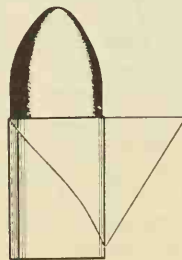
The rifling is of the shallow, wide groove type with narrow lands that has proven best with paper-patched bullets. It may be cut with uniform or "gain" (rate of twist increasing toward the muzzle) twist. Some shooters swear fervently that uniform twist produces

maximum accuracy, while others are equally adamant that *only* gain twist can do the job properly. I doubt if there is any difference, all other factors being equal. Both have won matches and set records — both now and 100 years ago.

Of course, the slug gun is normally of percussion lock design, though primer locks appear to be becoming more and more popular on modern guns. The under-striker lock is most often seen among new guns, mostly because it leaves the top completely clear for installation of a large target-type scope sight. Guns so equipped don't have fore-ends, just buttstocks. A fore-end only gets in the way on a rest gun, anyway.

Since the slug gun is shot only from bench rest, the barrel is usually fitted with a solidly-attached muzzle rest. This is of metal, sometimes aluminum, and flat across the bottom to rest on the bench or a shelf thereon. The rest prevents any canting whatever, which is of special value with guns producing relatively low velocity. The muzzle rest may be screwed or pinned to the barrel, or merely clamped around it. Some have even been formed integrally with the barrel.

The slug gun is shot with a large-caliber *swaged* lead bullet of relatively long length and cylindro-conoidal form with blunt nose. Bullets are smooth surfaced, and are not lubricated. Instead, they are encased during loading with a bond paper patch that is often oiled.



Typical slug gun bullet is long and heavy, swaged from soft lead, and wrapped carefully in a paper patch.

Each individual bullet is carefully made by hand. Nothing less than perfect bullets will produce the accuracy for which the slug gun is known. Two types of bullets are used. The solid or one-piece design is cast in a single piece from pure lead. The "composite" or two-piece bullet has the bearing surface portion cast from pure lead. The nose is cast separately from *hardened* lead and assembled to the body. A cavity in the front of the body accepts a tenon on the rear of nose, (or vice-versa) and swaging locks the two parts securely together. The hard nose of the composite bullet is intended to avoid deformation that might be produced on soft bullets by starter or ramrod. Pure lead is used for the body because it receives the rifling freely and more perfectly than any harder alloy. And, experience has proven that it normally produces best accuracy. Slug gun fans may not know why, but they do know what performs best.

Whether solid or composite, the slug gun bullet is always swaged. This serves two purposes — bringing the bullet to proper shape and size more precisely than it can be cast and compressing the lead to eliminate any voids or air pockets such as occasionally occur in even the most carefully cast bullets. Swaging must be done uniformly, the same amount of pressure being applied to every bullet, producing uniform lead density, weight, and length. Top shooters always check finished bullets for uniformity. Weighing each one separately may be best, but careful measuring of their length is equally effective in weeding out those that are too light or heavy. Length varies directly with weight, and measuring is much faster and easier to accomplish.

Swaging and casting proper bullets are covered in the chapter dealing with bullets and molds, so it would be redundant to go into the subject here.

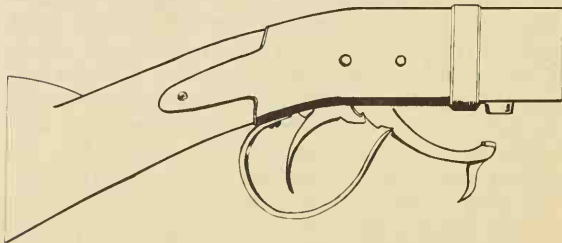
Slug gun barrels are rifled with wide, shallow, slow-twist grooves to produce best accuracy with the bullet enclosed in a paper patch. Such patches are cut from a high grade of 100% rag content bond paper. Most often the patch takes the form of two (sometimes three) separate strips of paper crossed to form an "X." Some shooters prefer to cut the "X" in one piece as a matter of loading convenience. The 2- or 3-strip patch is considered better, though, since strips can be cut with the grain of the paper. And, it is agreed that having the paper grain parallel with the bullet axis produces best accuracy. The patch is dimensioned so that when the bullet is centered on it and forced into the bore, the strips fold up along the sides. In this manner, they completely cover the bullet's bearing surface, without overlapping, and isolate the soft lead from the bore. Unlubricated lead rubbing on the bore will produce instant leading, fatal to accuracy. Failure to center the bullet accurately on the patch will spoil accuracy.

Patches are usually oiled before use. Bear oil was once the preferred lubricant, but few of us have the

opportunity to render out much bear fat these days. Neats Foot Oil, as sold for leather dressing, seems an ideal substitute, though many prefer pure sperm oil. Oiling is best done the day before use. Patches can be dipped or laid in the oil, then taken out and allowed to drain. To remove excess, place patches between sheets of blotting paper. Some guns prefer oilier patches than others, but a dripping wet patch is no good at all. Only experimental shooting will tell you which is best in a particular barrel. Once this has been determined, you'll know that soaking for 15 minutes, draining for 3 hours, then blotting for a specified time will produce patches perfect for a particular rifle.

Oiling not only lubricates the bullet's passage in ramming and firing through the bore, but makes the patch less likely to tear as the bullet is seated. And, a torn patch means a shot out of the group. Some guns have shot well with an un-oiled paper patch, but they are few and far between. It won't hurt anything to try dry patches in your gun a time or two to find out what happens.

While the older slug guns generally utilized a conventional side lock, modern guns are likely to be of under-striker type. Even so, the old timers sometimes used the under-striker. William Billingham produced very fine under-striker target rifles, as did several other makers. Early guns nearly always used percussion cap ignition, but in the constant search for better accuracy, both shotshell and metallic cartridge primers were tried late in the last century. Both Warner and Brockway produced devices to use primers in lieu of caps, and many modern guns are made with variations of those devices. As mentioned elsewhere, the modern primer is more uniform and reliable — being more highly developed than percussion caps ever were or will be. In "The Muzzle-Loading Cap Lock Rifle," the late Ned Roberts recommends primer ignition for his "ideal" slug gun. We'll go along with that and recommend primer ignition for any new gun you might want to build. Pistol primers, incidentally, possess all the power needed to ignite black powder.



The typical under-striker lock is popular for slug guns because of its simplicity and the fact that it is underneath the breech and out of the way of sights.

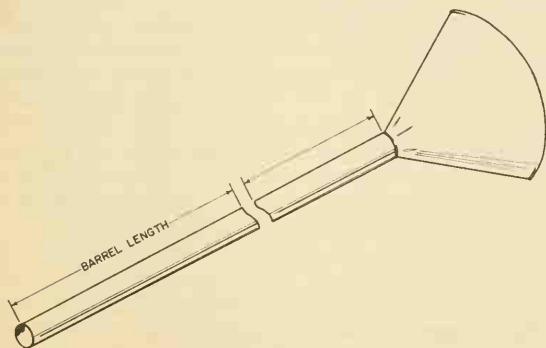
Of course, it goes without saying that whatever the type, the lock and other firing mechanism must be of the best quality and suited to the shooter's tastes. Set triggers are the general rule.

The slug gun will produce the accuracy for which it has become known only if all the components are perfect, and the utmost care is exercised in loading. This means perfect bullets, patches, and absolute uniformity in all loading operations.

As with any other muzzle loader, the bore must first be wiped clean and dry of oil or grease, and the nipple passage must be cleared by firing a cap (primer) or two upon it. Some shooters recommend wiping the bore with a dry patch after snapping the cap.

If you are a convenience-minded shooter, you will have placed pre-measured powder charges in plastic tubes or bottles before going to the range. Charges should be weighed or very accurately measured. Argument will wage forever as to whether weighing to ± 0.2 gr. is really essential to accuracy. However, it certainly can't do any harm. Because of wind and weather, it isn't practical to weigh charges on the range. The scale simply won't function uniformly in any appreciable air current. A good adjustable drum-type powder measure can, however, be used to throw accurate charges directly into the barrel at the range. The measure may simply be held over the muzzle, or clamped in a fixture that slips over the muzzle.

With bore clean and dry, the charge may be funneled directly into the muzzle. Little, if any, of it will cling to the bore if everything is dry and humidity is low. Even a single granule, though, *can* interfere with best accuracy by getting between bullet and bore, cutting the patch or notching the base in seating. This is best avoided by using a long-spouted loading funnel. A bore-size tube of barrel length is soldered to the funnel to carry powder to the breech without touching the bore. This is the only *sure* way of keeping powder from clinging to the bore walls.



A loading tube made by soldering a funnel to a barrel-length tube is a sure way of getting all the powder to the chamber area.

Any new rifle will be furnished with powder charge recommendations, and original or used guns should also be accompanied by some data on what has been used. If you've nothing at all to go by, there are several old rules of thumb that can be used. Simplest is the one that goes, "Use $1\frac{1}{2}$ calibers of powder for rifles under 70 gauge (.40 caliber) and 2 calibers for those over that gauge." This means you simply multiply the caliber in hundredths of an inch by $1\frac{1}{2}$ or 2 to get the powder charge weight in grains. Thus, a .50 caliber rifle charge would be $50 \times 2 = 100$ grains of powder. For .38 caliber, it would be $38 \times 1\frac{1}{2} = 57$ grains. Charges figured by other rules will be fairly close to the above, so we quote only the one rule. Some conservative shooters feel charges figured this way are a bit heavy, preferring to start a charge weight equal to the caliber; 40 grains for a .40 caliber barrel. Since this is only a starting point, it doesn't really matter which you use.

Keep in mind that charges so computed are only approximate and that best accuracy will undoubtedly be produced by a bit more or a bit less powder. Generally speaking, use ffg powder in barrels over .45 caliber, ffg in those under that. Try both, though, for rifles vary widely in their preferences.

Place the gun upright in the loading rack and check to make certain the false muzzle is properly seated. Even a single powder granule or piece of dirt between it and the barrel will result in the bullet being seated at a slight angle, reducing its accuracy. Assuming you are using a 2- or 3-strip patch, slide the strips into their respective slots in the face of the false muzzle. They must be precisely centered and not wrinkled or torn. They should also be checked to determine that they are neither too dry nor too oily. If oiled too soon before shooting, they may be too wet; if too long before, too dry. Once the proper degree of oiliness is determined for best accuracy in a given barrel, adhere to it strictly. Store ready-oiled patches in air-tight tins or plastic boxes to keep oil from evaporating.

Inspect the bullet. It must be free of nicks, scratches, or dents, especially at the edges of the base. Any base deformation whatever will reduce accuracy. Though a bullet may have been cast and swaged perfectly, it is quite soft and can easily pick up defects before the time comes to load it. Bullets are best kept in a block or compartmented box having a separate space for each individual bullet. Even then, very careful handling is required. The more perfect the bullet, the greater accuracy will be produced. I've known some shooters to arrive at the range with bullets wrapped in cotton batting. Others do the swaging just before loading to reduce bullet handling.

Center the bullet over the patch and false muzzle and press it in gently with the fingers. Seat the bullet starter on the false muzzle and press it gently down as far as it will go. Note carefully whether the patch

strips are folding up evenly. If one leans sideways or wrinkles, that particular bullet won't go as close to point of aim as it should.

Strike the knob of the starter a single, solid blow with the heel of the hand, seating the bullet the full length of the starter. Take the time to learn just how heavy a blow is required, then strive to make it uniform from shot to shot. Even with composite bullets, some point deformation will result if the blow is too heavy. The point will also be deformed if the blow is too light and a second one is necessary to complete the seating operation. As in all other operations, absolute uniformity is the ultimate goal, and is essential in producing best accuracy.

Lever-type bullet seaters as encountered on false-muzzle Schuetzen rifles may also be used. Even with them, uniform pressure is required.

With the bullet properly started, remove the starter and insert the ramrod in the barrel, resting on the bullet. Then, with a single, smooth motion, run the bullet fully down on the powder. The bullet must be seated firmly on the powder, yet without too much pressure. And, it must be seated the same every time. If the powder charge is felt to "give" just a small amount, seating pressure should be just about right. If the ramrod stops part way through the operation and a second stroke is necessary to finish the job, that bullet will be out of the group. Barrels are finished with a slight constriction or choke at the muzzle and the starter is intended to carry the bullet through this area. Ramming then requires relatively little pressure, since in passing through the choke the bullet has been swaged slightly smaller than the balance of the bore. Most shooters use only enough fingers in gripping the ramrod to insure single-motion seating of the bullet. This avoids having an excess of strength available which can result in too-hard seating of the bullet. The ramrod must be stiff enough that it won't bend and rub the bore.

If one just happens to seat a bullet *without* cleaning the bore, it may be impossible to start it moving again with the ramrod. This situation may call for disassembly of the gun in order to drive the bullet out from the breech.

Make absolutely certain the false muzzle is removed next. Don't laugh. Many a rifleman has fired, only to see the false muzzle go sailing downrange. Most false muzzles have some sort of protrusion that blocks the line of sight. Then, any attempt at firing makes it obvious the device is still in place. If your false muzzle isn't so equipped, I recommend you attend to that detail immediately. If you don't, there is bound to come the day when you'll shoot off the muzzle. This is not only highly embarrassing, it ruins your score — and can also ruin the false muzzle.

All that remains is to place the cap (or primer) on the nipple, and the gun is ready to cock and fire.

The slug gun demands a perfectly solid and rigid rest. If you don't have a bench that meets these requirements, you'll never know just how well your gun can shoot. You'll never know when the load and loading is exactly right because there will be "bench error" enlarging your groups. The goal of slug gun shooting is maximum gun/load accuracy, and no outside factors should be allowed to influence it.

Rest shooting requires as much uniformity in firing the shot as in loading the gun. It might seem that with so heavy a gun solidly rested, minor shooter inconsistencies will have no effect. Tain't so. Even shifting your derriere's position on the stool or chair can cause changes in point of impact. You must sit the same; shoulder and cheek the gun the same; press the trigger the same; etc., for every shot. The gun may shoot better held lightly, or it may prefer to be gripped tightly. It may prefer to recoil fairly freely, or to be held up somewhat. Individual guns behave differently. The best approach is to start with good basic benchrest shooting techniques and then vary only one factor at a time until the most accurate combination is found. One well-known shooter says he gets better accuracy shooting while kneeling on the ground instead of sitting on a stool or chair. He must be right, because he wins matches. What works for him is not necessarily best for you and your gun, but try it anyway. Then you'll know.

In any event, get that first shot off carefully, making mental note of just how you performed each function. Everything will have to be the same for each subsequent shot.

Let's assume the first bullet was on target and take it from there.

If it wasn't, you'll have to spend a few rounds zeroing, but that can be combined with learning to load and handle the big gun correctly. After the shot, half cock the hammer and remove any cap fragments or, if a primer lock, remove the fired primer. Set the gun in the loading rack.

Cleaning the bore after each shot is essential to the production of top accuracy. It is equally essential that the cleaning be performed exactly the same each and every time. A wet bristle (not metal bristles) brush or patch is used first to loosen the fouling, being passed the full length of the bore the same number of times after each shot. Then, a clean dry patch is used to swab out the loosened fouling, followed by a final clean patch to completely dry the bore and pick up any fouling missed by the first. The number of patches and number of passes through the bore is of no great importance so long as the bore finishes clean and dry and the operation is performed in exactly the same manner each time. Some shooters blow through the nipple or run a pipe cleaner through it to dry it out before the last dry patch is used. Others snap a cap on the nipple after cleaning, but before reloading.

Obviously, there must be no water in the nipple when the gun is fired. Shooters have been known to load and fire the next shot into the dirt if a goof was made in cleaning, knowing that bullet might open up the group.

Regardless of exactly how you wind up cleaning the bore between shots, develop a fast, rhythmic routine for it so as to insure uniformity without waste of time and effort. A hardened steel cleaning rod is best since it will not pick up and hold abrasive fouling or dirt which can eventually wear away the rifling. Wiping the rod clean after each use is a good idea.

With the gun cleaned, set the hammer at half cock. Note that this is contrary to rules given for loading other guns that are not cleaned after each shot. The water cleaning eliminates any possibility of there being an ember that might ignite the charge. With the hammer at half cock, air compressed ahead of the bullet during seating can easily escape. If trapped by a tightly-sealed nipple, compressed air might force the bullet up off the powder, producing at best a poor shot — at worst a “ringed” barrel.

Repeat the complete loading procedure, again with emphasis on uniformity of every component and every action. Concentrate on developing an unbroken loading routine that insures uniformity.

Do not, under any circumstances, allow others to interrupt or intrude during loading. Shooting records are full of incidents where a top shooter lost a match because fans interrupted and caused a loading error.

Fire several shots before judging the accuracy of the gun or “going for record.” Heavy slug gun barrels must “warm up” (both literally and figuratively) before they shoot their best. Eventually, you’ll learn whether 3-, 4-, 5-, or more shots are required to condition your particular barrel for its best 10-shot group. No matter how small and insignificant such factors seem, they are important in achieving maximum accuracy.

As shooting progresses and you develop proficiency with the big gun, you’ll note many factors affecting its day-to-day accuracy. This necessitates the keeping of a comprehensive scorebook or log book. This really should be done from the first round fired from a new or newly-acquired gun.

Record each group and load, along with temperature, wind direction and velocity, humidity, barometric pressure, etc. If you travel a good bit and shoot at places differing considerably in elevation (altitude) record that also. If loading routine is altered, it too should be recorded along with any visible effect it produced on target.

If such records are kept assiduously, and studied periodically, they will give vital clues to improving the gun’s performance.

For example, you’ll find that under certain weather conditions groups begin to open up, but can be brought back in by reducing or increasing powder charge. Once

this is known for your particular rifle, you can second-guess the weather and load specifically for it.

Another thing you might notice is the effect of hot, direct sunlight on center of impact. U. S. Army tests years ago confirmed that a heavy barrel long exposed to bright sun will shoot away from the sun. This is due to expansion and elongation of the side of the barrel facing the sun as it heats up causing the muzzle to move ever so slightly away from the sun as the barrel bends. This is ample reason for never leaving your gun laying in direct sunlight while waiting to shoot. Even though the shaded inside of your car might seem like an oven, the barrel will heat uniformly there and remain straight.

It is interesting that a 90mm tank gun tested for the sun’s effect in desert-like temperatures walked its center of impact in a U-shape pattern around the point of aim as the sun moved through its full travel. This was with the gun pointed due south.

A slug gun’s behavior may change. That is, the load developed today may not shoot as well next week. One set of rules says “When groups with one-piece bullets open up vertically, add powder; if horizontally, reduce powder. Reverse for two-piece bullet,” and “If one shot is out of the group, decrease powder charge.” Then, a gun’s behavior may change as one season moves into another, being affected by temperature and humidity.

Such rules may apply to your rifle or they may not. You must experiment to find out. When you first encounter vertical or horizontal stringing of the group and are certain it isn’t *your* fault, vary the powder charge both ways to determine which is the proper corrective action. Most important of all, keep a record. Then, the next time the same thing happens you can correct it immediately and positively instead of fumbling in the dark. A slug gun is somewhat like a wife or mistress in that one must know it intimately and treat it correctly in order to get the most out of it.

Because of its temperament, the slug gun must be cared for carefully. The least marring of the muzzle or the false muzzle is fatal to accuracy. Degrees of other wear and tear that are acceptable in sporting guns can easily result in decreased accuracy. Erosion and enlargement of the nipple vent, or uneven hammer/nipple contact can cost you points. Best use an Ampco or carbide-lined nipple to avoid this. Loss of mainspring tension can produce non-uniform ignition, even though every cap or primer seems to fire correctly. Tests by Ed Yard prove conclusively that primer energy, consequently, ignition varies directly with hammer or firing pin energy. While black powder is relatively easy to ignite, variations in ignition can occur, and they effect velocity, which in turn effects vertical dispersion on target.

Probably no other type of shooting requires the minute attention to detail and uniformity demanded

by the heavy slug gun. Even the centerfire bench-rest shooter is less plagued by minutea.

He, at least, needs concentrate only on shooting, once he's loaded his 10 rounds. The slug gun shooter probably expends more physical and mental energy on

a single shot than a breech-loading man does on an entire 10-shot string.

The slug gun demands the most from the shooter — but it will return equal measure in accuracy and sense of accomplishment. It represents the epitome of muzzle-loading guns and shooting.



Chapter 9

SHOOTING THE SCATTERGUN

Once the trailbreakers had passed and cabins and homesteads began springing up, the muzzle-loading shotgun was more likely than the rifle to be the family defender and provider. Often as not, it might be an old smoothbore musket stripped of its excess weight and hardware and loaded with anything from factory-swaged buckshot to a handful of gravel. Shot, as we know it today, wasn't available on every street corner and it wasn't unusual for it to be made at home.

Large buckshot could be cast like bullets and, of course, the larger balls for "buck and ball" loads were easily molded. Shot was another matter. Obviously, no one could afford to build his own shot tower on the frontier. So, as has been done since almost the beginning of firearms, shot was *cut* from sheet lead. One simply peeled a narrow strip from one edge of the sheet, and then chopped it roughly into cubes. Many a man alive yet today remembers cutting shot as a boy. With a supply of sheet lead at hand, one man could make shot, or cast balls or conical bullets as desired and the cost was less than for store-bought "dropped" shot.

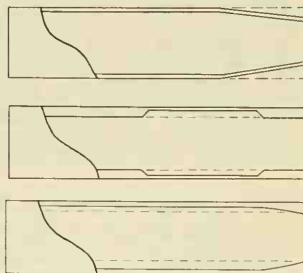
Square or cubical shot may not sound like much today, conditioned as we've become to 80% and 90% patterns from commercial loads. Yet, it seems the boys managed to kill enough game with it to feed their families and, on the frontier, this assumed considerably more importance than paper pattern density.

Original muzzle-loading shotguns were cylinder-bored — without a choke. Lots of guns are shot today without chokes, but more and more shooters are having their guns reworked. Apparently, it was only recently that the choke was considered practical in a barrel loaded from the muzzle. Be that as it may, match winners of today do use choked barrels.

A number of gunsmiths are set up to choke cylinder-bore guns. The simplest, quickest, and probably least desirable type is the "Swaged" choke. A tapered hollow punch is driven over the muzzle, constricting the barrel slightly. Next in line is the "jug" or recessed choke. The bore is enlarged behind the muzzle for a few inches, then tapered back down toward the

muzzle. The best method calls for enlarging all but the last few inches of the bore near the muzzle, working from the breech. A conventional choke is then formed at the muzzle.

The last two methods require that the barrels have walls thick enough to stand removal of a significant amount of metal — and many oldtime guns don't meet that requirement. For them, the swaged choke is the only solution. And, for all its theoretical weak points, it seems to do rather well.



Muzzle loading shotgun barrels may be choked in one of the above ways. Top consists simply of swaging the muzzle inward on a taper. Middle, a recess is bored in the barrel behind the muzzle, and bottom the entire barrel is bored out to large diameter, leaving the muzzle constricted to produce the choke. The last two methods require fairly thick barrel—something many of the old timers don't have.

Procuring a shootable muzzle-loading shotgun follows the same guidelines set forth in regard to other guns. Make certain you have a *safe* gun before loading up and shooting from the shoulder. Replacement eyes and arms are hard to come by.

You'll need caps, powder, wads, and shot. Caps must, of course, fit the nipples of your gun snugly, and the powder should be ffg granulation. Some shooters recommend fg in 16- and 12-gauge, but I feel that's too coarse. Shot size choice depends on what you intend to shoot, and since every one has his own ideas on that, far be it for me to try to change any minds. In any event, buy good shot. Don't try to make it yourself.

Wads are another matter. It will pay you to make your own, especially if your gun's barrel has been polished or freshed out. Barrels vary a great deal in bore diameter, consequently, standard size wads are often too loose or too tight. It will be best eventually to make a wad cutter from tubing or pipe of exactly the right diameter for your barrel. Make it as outlined for a patch cutter in the accessory chapter.

For a starter, though, you can use store-bought wads or cut them with a standard gauge cutter obtained from DGW. Use a card wad directly over the powder, and it should be tight in the bore. If making your own, use 3/32" to 1/8" thick sign cardboard. One goes over the powder, followed by a 1/4" or thicker filler or cushion wad. Store-bought fiber or composition wads are fine. If making your own, upholsterer's felt is best, though cheap, celotex-type insulating board can also be used. Another card wad goes over the shot, and it must also be quite tight in the bore. If it isn't, recoil of the first shot in a double gun will loosen the charge in the other barrel.

Many a shooter has started by using toilet tissue for wadding — three or four sheets tamped down over the powder, one over the shot. Guns so loaded will shoot and kill game, but not as well as when proper wads are used. There is also the possibility of fires being started by smoldering pieces of tissue.

Begin loading by wiping the bore and clearing the nipple by firing a cap or two. Working from the charge table given below (which is conservative) or those appearing in Appendix 4, pour the powder down the barrel.

Gauge	Powder	Shot
20	2¼ dr.	⅞ oz.
16	2¾ dr.	⅞ oz.
14	3 dr.	1 oz.
12	3¼ dr.	1½ oz.
11	3½ dr.	1½ oz.
10	3¾ dr.	1¼ oz.

Start the over-powder card wad in the muzzle. If it's not a snug fit, it may fall edgewise on the powder. If that happens, the ramrod may simply shove it into the powder charge, or flip it over so that part of the charge is on top of the wad. So make sure the wad is pressed smoothly into the bore and seats squarely on the powder. It doesn't require pounding into position — just solid seating, compressing the powder slightly.

Start the cushion wads in the muzzle and give them the same treatment. Cup grease applied to the edge of the wad will keep fouling soft, but makes loading rather messy. One shooter recommends occasional use of two card wads with a layer of grease between them to keep fouling soft. Some shooters substitute additional card wads for the cushion wad, but the latter produces less shot deformation during initial acceleration of the charge.

Follow with the shot charge, also given in the foregoing table and in the appendices. Start the over-shot card wad, then seat it solidly with the ramrod. This wad *must* be tight in the bore. If it feels loose as it seats, don't pound on it in hope of making it stay in place. Draw it out with your worm and start over with a tighter wad. Make certain it doesn't tip and scoop part of the shot charge up to lay on top of the wad.

With the hammer at half cock, cap the nipple, and you're ready for the morning flight. Of course, if your gun is a double, both barrels will have to receive the same loading treatment. This brings up a couple of safety precautions that must be taken with doubles. Loading must be very carefully regimented or sooner or later you'll get *two* charges of powder in one barrel and none in the other. A double charge *may* not wreck the gun, but I'll guarantee it won't do either your shoulder or peace of mind any good. Develop a set loading routine, and don't allow it to vary.

Often you'll need to reload only one barrel after firing a single shot. *Don't* forget to take the cap off the still-loaded barrel!

Much of your shooting will be single shots. While a well-loaded charge will remain in place against recoil for a shot or two, repeated firing of one barrel *will* loosen the charge in the other. Should you then happen to fire *both* barrels and the one shot charge has moved a few inches, a bulged or burst barrel will result. I prefer to fire both barrels alternately to preclude any such happening.

Naturally, all the safety precautions already outlined in regard to other long guns must be strictly observed.

The average muzzle-loading shotgun in good condition can be loaded up, taken afield, and will kill *some* game if you're any sort of a marksman at all. But, if you'll take the time to try it at the pattern board and work up the load that produces the best pattern, the odds grow mightily in your favor.

Varying powder charge, wad column, and shot charge all have their effect on patterns. The effect isn't predictable, but it's there. Vary both shot and powder charge both ways and note the effect on patterns. Do the same with wad column, wad material, ramming pressure and shot size. After a few conscientious range sessions devoted to this sort of experimentation, you may easily wind up with as much as 15% to 20% better patterns. And, rest assured, that much improvement will put a lot more meat in the pot.

The front-loading scattergun can often be just as effective for one or two shots as the most modern breech loader. A new, properly-choked double that is carefully loaded from the muzzle will kill just as far and just as cleanly as any cartridge gun made — it just can't be reloaded very fast. Considering today's bag limits, that isn't as great a handicap as one might think.

Chapter 10

BULLETS AND BULLET MAKING

Muzzle-loading shooters of yesteryear tried all manner of bullets in developing what we use now. If some of their efforts look ridiculous today, it's because they were probing an unknown field in attempts to produce accuracy and effectiveness on game and target. Before you laugh or sneer at old bullets, just remember what the autos and airplanes of a mere 50 years ago looked like. They seem pretty silly, too, but were an essential part of the development of what we have today. Laugh at the deformed, hammered-down, naked lead bullets of the 18th Century Jaeger rifle if you must, but remember that they gave birth to the patched ball of the Kentucky rifle and many other subsequent developments.

Today, we use the following bullet types in muzzle loaders: cloth-patched round ball; grooved lubricated hollow-base "minie" bullet; paper-patched, solid lead, unlubricated bullet.

All are customarily cast from the softest and purest lead available, though, for casual shooting, many shooters will use anything that resembles lead. It is generally conceded that pure lead gives the best results but the difference is often so small it can be ignored without serious consequences.

Casting techniques are essentially the same for all types, and are the same as those used for cartridge bullets. Equipment can range from a tomato can and spoon used over the kitchen range with an old finger-burning brass mold up to a modern thermostatically-controlled electric furnace and heavy multiple-cavity molds.

Much has been made of the romantic scene of the frontiersman molding rifle balls over a tiny campfire hidden deep in the forest. No doubt this happened often enough, but I suspect more legend than fact is contained in that scene. Carrying a melting pot, ladle, mold, and bar lead doesn't really fit in with the mountain man's concept of mobility. Bar lead was certainly obtained on trading trips, but it and bullet-making equipment were undoubtedly cached along with other occasionally-needed items. The cache could be visited when replenishment was necessary. After all, the fron-

tier rifleman didn't shoot for fun except when visiting "civilization." He expended powder and lead only for food and in defense of his scalp.

With small caliber round ball rifles, a horn of good powder would take care of 150 to 200 shots, and an equal number of, say, .36 caliber balls weighing only 1½ pounds or less, could be carried in a bag no larger than your fist.

Considering that the working rifleman would average probably less than a shot per day, it can be seen that Natty Bumpo didn't have any real reason to cast bullets very often.

The round ball devotee using arms of .30, .32, .36, and .44 or .45 caliber doesn't even have to concern himself with casting bullets. Commercial swaged buckshot is available in sizes correct for the three smaller calibers. Swaged balls are available in the larger calibers.

Both buckshot and the large balls are formed in automatic "cold-heading" machines from lead wire. Wire is fed directly into these machines, cut to length, and squeezed to spherical shape between two hollow-ended punches — all faster than the eye can follow. The swaging operation closes any voids that might exist, producing round balls of very uniform weight and diameter. Once formed, the balls are tumbled in powdered graphite which gives them their blackened, dirty appearance. The tumbling also produces the numerous flats and dents one sees on the balls' surface. This rough appearance leads many to believe such balls can't possibly shoot as well as one gleaming and freshly cast. But they do. In fact, many guns deliver better accuracy with these commercial balls than with the hand-cast variety. No cast bullet is as uniform as a swaged bullet, and so it is with commercial round balls. Personally, I consider them a blessing and hardly ever cast a ball unless it's a size not available ready-made.

The traditional bullet casting setup consists of a cast iron pot (often with a heat shield) intended to be set on the old coal- or wood-burning kitchen range; an iron ladle; a single-cavity brass or bronze mold;

and a knife or nippers with which to trim the sprue. The pot and ladle work fine today — even better than before with gas or electric ranges whose heat can be carefully controlled. Yesterday's mold, though, leaves a lot to be desired. Its short, all-metal handles are guaranteed to blister your hands in short order. The small blocks overheat rapidly, and the sprue-cutter (if there is one) is too flimsy to do a proper job. If you do plan to use such molds insulate the handles or attach wood extensions.

Far better are the modern separate-block molds produced primarily by Lyman Gun Sight Co. and to a lesser degree by SAECO and Hensley & Gibbs. As you get deeper into muzzle-loader shooting, by all means, try the old molds. But, in the beginning, use the modern type and far better bullets will certainly result.

In making the foregoing statement, we don't mean to downgrade the very fine molds furnished with high-grade rifles by makers such as Billinghamurst, Brockway, Whitmore, Pope, etc. Those molds are works of art and easily produce perfect bullets. They resemble modern molds more than the old timers. But, they represent only a very minute percentage of the old molds encountered. They are in themselves collector's items.

Except for the nose portion of composite slug gun bullets, begin with the purest lead available. The temptation to use everything from auto wheel weights to junk battery plates is great, but it really can't be justified in the end if you want the best accuracy possible.

Commercial pig lead can be obtained as this is written from most large plumbing supply shops at 30-35 cents per pound. Since a pound will produce 100 .36 caliber round balls, this isn't at all prohibitive. Scrap lead of unknown content will cost half to two-thirds that much, and isn't nearly as satisfactory.

A bullet mold is simply a pair of metal blocks into which has been cut a cavity shaped exactly as the finished bullet. Molten lead is poured into this cavity. After hardening, the blocks are separated and the bullet falls out. The grooves on the bullet are filled with lubricant, and the bullet is forced through a smooth hole to bring it to precise diameter and roundness. Now, it's ready to load and shoot. Nothing to it — or is there?

Let's take handgun bullets first, for the short guns are less critical of minor qualitative and quantitative variations, and are far more tolerant than rifles of lead temper (hardness) and bullet shape. And, it's easier to cast good ones. In spite of all this built-in forgiveness, perfect bullets are no less desirable.

Whether you're using a Lyman pot on Mama's gas range or one of the big electric outfits, lead must be melted and heated to a temperature where it will flow as freely as water. As it becomes fluid, dross (dirt, grit and impurities) floats to the top and must be skimmed off.

When the lead is hot enough to char a dry wood splinter without it bursting into flame (or at about 700



A variety of old-style molds as they are produced today in replica form by, oddly enough, Replica Arms. Those with plain, short metal handles become impossible to use after

casting only a few bullets. The second from left, copied after Colt Paterson molds is somewhat better, but still difficult to use because of the extreme shortness of the handles.



Photo courtesy of Handloader Magazine

Not much is really needed to cast good bullets. The simple layout here is plenty; melting pot; mold; dipper; lead, hammer handle for striking the sprue-cutter; and an ingot mold in which to pour leftover lead. The latter isn't at all necessary, but is convenient.

degrees F. with a controllable heat pot), drop in a bullet-size lump of grease. Much has been said about special fluxes and greases, but the lubricant you'll be using on the finished bullets works about as well as anything I've tried.

This will boil and bubble, smoke a lot, and stink up the whole house — so don't do this while the lady of the house is entertaining her Kaffeeklasche. The uproar won't last long, so a fan and an open window will clear things up in a hurry. Or, you can carry the pot outdoors for fluxing if you've a tyrant for a housemaid. If the kitchen range has an exhaust hood and fan and you can work there, you're in real luck.

As soon as the smoke has cleared away and you've assured the hysterical neighbors that there's really no fire, stir the mixture well, wait a few seconds, and skim off the dross. An old, large serving spoon with a few small holes punched or drilled in its bottom works quite well for this. What's left should be reasonably pure lead — just what is needed for good bullets or balls.

While the lead was melting, you should have washed all grease and oil out of your mold in solvent or gasoline. If the latter, I hope you didn't do it indoors. And, if you had set the mold on the edge of

the pot to warm up, you'd be a few minutes ahead of the game. But no matter, it will heat quickly enough as casting progresses.

Better make a last-minute check to insure no foreign material is on the block faces, thus, keeping them from joining completely together.

Hold the mold in one hand (left, for a right-hander), with cavities *parallel* to the floor, cut-off plate toward the pot. Take the Lyman dipper (the one with the integral pouring spout) and immerse it in the lead for a few seconds to heat up. Unless the dipper is hot, lead will "freeze" in the spout. Lift dipper horizontally and bring its spout into firm contact with the sprue hole in the mold cut-off plate. Holding dipper and mold firmly together, rotate them to an upright position (counter-clockwise for a right-hander) and hold steady. The lead will flow from dipper to mold and the excess lead in the dipper will exert pressure on that in the mold, forcing out air and filling all nooks and crannies.

Separate dipper from mold, rolling the two apart so that no lead is spilled. A small puddle of molten lead should remain in the sprue hole, and will harden in two or three seconds. You'll see it rapidly change color and texture as it solidifies.

In the event, you are using a bottom-draw electric pot for your first bullets, we'd better cover that somewhat different procedure before continuing. The spout valve on the bottom of such pots is opened and closed by a handle connected to a rod dropping down through the molten lead. An adjustable stop controls the amount the handle will move, thus the rate at which lead will flow out the spout.

The spout appears to be made to insert in the sprue hole of the mold, and in truth, that is the way the makers intend it to be used. By all means, try it that way, but in my own experience, it seldom works well. Better results are often obtained by letting lead run freely into the sprue hole. Build up a support that will hold the mold with sprue hole directly under the spout and about a half inch below it. Scrap wood works fine and so, sometimes, does a common brick. Lyman makes an excellent "Mold Guide" that bolts directly to the furnace for this purpose.

If using wood, wrap a piece of aluminum foil over it to prevent spilled (yes, you'll spill some) lead from adhering to it. Wood has the added advantage in that you can drive a few nails into its top, forming a sort of pocket for the mold, aligning it with the pot spout. This will save a lot of time getting the mold in the right place each time.

Slide the mold under the spout and raise the valve handle very carefully. The stream of lead should enter the sprue hole dead-center. If lead splashes over the side, the stream is too big and must be reduced by cutting down the valve opening. Adjust the valve handle stop.



Photo courtesy of Handloader Magazine

When dipping from the pot, whether it be the fine thermostatically-controlled SAECO unit shown or a tin can set on the kitchen range, submerge the dipper deep in the molten metal, tit its nozzle to the sprue hole while still horizontal, and then turn mold and dipper upright together so that the weight of metal in the dipper will force lead into all corners of the mold.

As soon as lead wells up in the sprue hole, close the valve by letting the handle drop. Fast action is called for here, or lead will overflow and freeze on the mold preventing the blocks from being opened. Cutting and prying such spillage off is a chore, so avoid it.

Fast action is called for with the valve handle, and you'll no doubt invent a few new cuss words before you've learned to avoid overflow.

But, back to the pot and dipper method. The dipper should be immediately returned to the pot so it will stay hot. When the sprue (that puddle of lead) has hardened, it's time to open the mold. First, the cut-off plate must be swung aside, cutting the sprue from the body of the bullet. This is best done by a sharp, light blow on the cutoff plate arm.

Never use a metal bar or hammer; the plate can be bent or warped. Instead, use a stick of hardwood (an old hickory hammer works well) or a plastic mallet. Never strike up or downward at the plate. This also will deform it so it will not lie flat on top of the mold blocks, causing lead to leak from under it.

With a little practice, you can cut off the sprue and have it fall directly into an old sardine can for eventual return to the pot.

Open the mold by spreading the handles apart. If the bullet doesn't fall out readily, rap the top of the mold hinge joint with the same instrument used on the cut-off plate (never a metal object). This will jar the bullet loose out. As the bullet comes from the mold, it is still quite hot and soft enough being dropped on a hard surface will knock it out of shape. Fold an old towel or piece of blanket into a pad on which bullets can be dropped and left until cool.

Man, that first bullet you just cast sure is a mess, isn't it? Full of wrinkles, rounded edges and voids. What's wrong? Nothing. The mold won't make perfect bullets until it has been warmed up. And, if it's a new mold, it won't turn out good ones until it has been broken in by casting 100 or so slugs.

After becoming hot enough to cause a drop of water to dance and sizzle audibly (the old-timers spit on them to check this), the mold should turn out well-formed bullets. If it doesn't, the *lead* probably isn't hot enough, so turn the heat up a bit, and keep trying. Eventually, you'll get good, if not perfect bullets. It may take a few hours' experimentation with mold handling and lead temperature. Adding more flux will often make the difference between bad and good bullets.

Soon, though, you'll get the hang of it and be able to turn out a pair of bullets per minute, even with only a single cavity mold. You may find that after quite a few have been cast that they come out of the mold with a frosted appearance and the sprue is taking a longer time to harden. Either the mold, or both lead and mold are too hot.

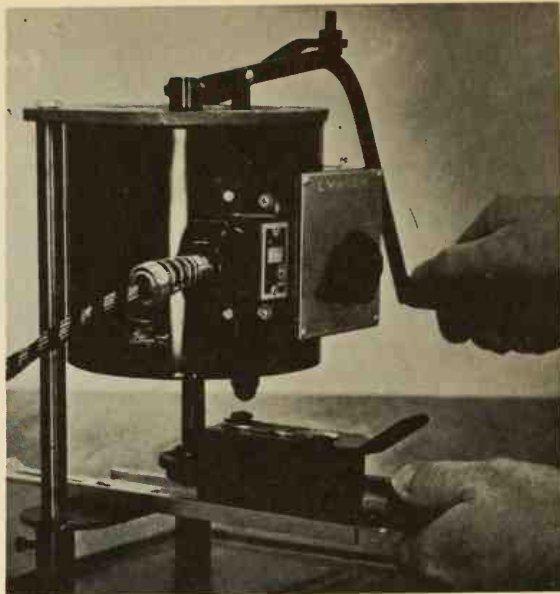


Photo courtesy of Handloader Magazine

When using a bottom-draw pot such as this Lyman unit it is sometimes better to have the mold a short distance from the spout. Using the Lyman Mold-Guide shown simplifies this considerably and also makes handling multiple-cavity molds a lot easier.



Photo courtesy of Handloader Magazine

The hardened sprue should look like this. Never use a hammer or other metal object to strike the sprue plate and never strike the mold proper. The plate must be struck in a line parallel to its face—any other angle will eventually bend it causing uneven bullet bases.

First, try slowing down the casting, and if that doesn't do the trick, turn down the pot heat a bit. If this seems to slow production too much, then immerse the mold, *closed with bullet and sprue in place*, in a bucket of lukewarm water for a few seconds. This will cool it off quickly and allow casting to continue faster. Some people I know work so fast they dunk the mold every half dozen bullets.

By now, you're getting pretty good bullets (or, at least you think you are), and you've decided there really isn't much to this casting bit. But you're wrong. There's a lot more to it. Take a few of those bullets and look them over closely under a magnifying glass. Are the edges of the bands and grooves as sharp and clean as they appear in the mold cavity?

Are the bases clean and square with no "tail" or ragged cavity where the sprue was cut away? Do you find any holes when probing with a pin where the sprue was cut? Split a few bullets lengthwise. Do you find air holes and voids? Weigh a dozen bullets carefully. If you don't have an accurate scale, call on your friendly pharmacist for help. Are they uniform in weight? Borrow a micrometer (you really should have a good one, you know) and check a dozen bullets for diameter. Are they as uniform as you thought?

Running through this list of tests, you'll find enough wrong with your new bullets to deflate your ego a bit, maybe even to make you think the equipment isn't any good. But don't throw anything away. That setup will give you perfect bullets virtually every time it's heated up, once you learn the tricks of the trade. Don't be discouraged for there are many things you can do to eliminate the defects you discovered. And, when you can do these tricks, you'll make bullets that have a natural-born "X-ring" tendency.

Wrinkled irregular surface: Check first to make certain that no oil or grease is present in the mold cavity. Check temperature of both mold and bullet metal. If either or both are too cold, this defect will be produced. If you have just begun to cast, continue casting to bring the mold up to proper temperature. If casting 15 or 20 bullets does not produce any significant improvement, increase the temperature of the lead also. These factors often require considerable juggling.

Bands, lubricating grooves, and other sharp edges not filled out cleanly in exact duplication of the mold cavity: If using the hand-dipper, keep a larger quantity of lead in it and keep in contact with mold for a longer period of time. The weight of additional metal in the dipper, applied for a longer period of time to the fluid metal in the mold will force lead into the mold's nooks and crannies. If using a bottom-discharge furnace, open the valve more, and hold it open for a longer period of time.

Next, try additional fluxing of the metal in the pot. Some mixtures may require more frequent fluxing than

others to flow well. If the condition persists, there may be insufficient tin in the alloy. A very small amount of tin will often make the mixture flow better and won't harden the lead enough to cause trouble. Up to 1-part tin in 40-parts lead will improve casting without impairing accuracy.

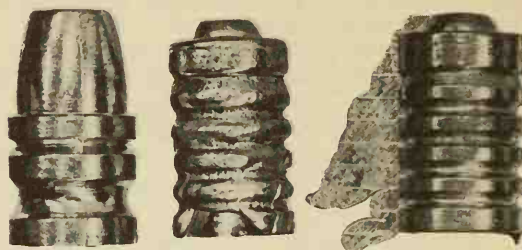


Photo courtesy of Handloader Magazine

Left is a properly cast bullet with all areas of the mold fully filled. Center is the first bullet of the day, lead not quite hot enough run into a cold mold. Waiting until the lead became hot enough and pre-heating the mold on the edge of the pot would have made the effect far less pronounced. Right is a bullet deliberately cast to produce a thick tin on one side. Anything that interferes with complete closing of the mold blocks will produce this same effect to a lesser degree; we deliberately emphasized it here.

If all else has failed, it may be that your bullet metal has been contaminated by zinc, aluminum, or one of the other materials that act to greatly increase the surface tension of molten lead alloy. This contamination can easily exist when scrap lead from the local junk yard is used. Particularly, soldered joints found on some cable sheathing can contain impurities. Once so contaminated, the metal is of no further use for casting "good" bullets. You may as well use it to make vise jaws or door stops.

Air trapped in the mold can also prevent filling out the sharp corners. Modern molds have the blocks machined on their matching faces with a series of regular, shallow grooves which allow air to escape as lead flows in. These grooves can become clogged, trapping air. Cleaning with solvent and an old toothbrush will usually do the trick. *Don't* use steel tools or abrasives.

Older molds were made with smooth faces, and often required "venting." This consists of very carefully filing a minute groove from the offending portion of a mold to the edge of the block, thus, providing an escape passage for trapped air. I don't recommend attempting to vent a mold yourself — the factory is far more able to do a proper job.

Edge of bullet base not fully filled out: This results also from trapped air, and is usually corrected by slightly loosening the cut-off plate screw. The plate must swing freely yet not be held so tightly against the face of the blocks that it prevents the escape of air. Grease and oil between the plate and the blocks can also contribute to the problem.

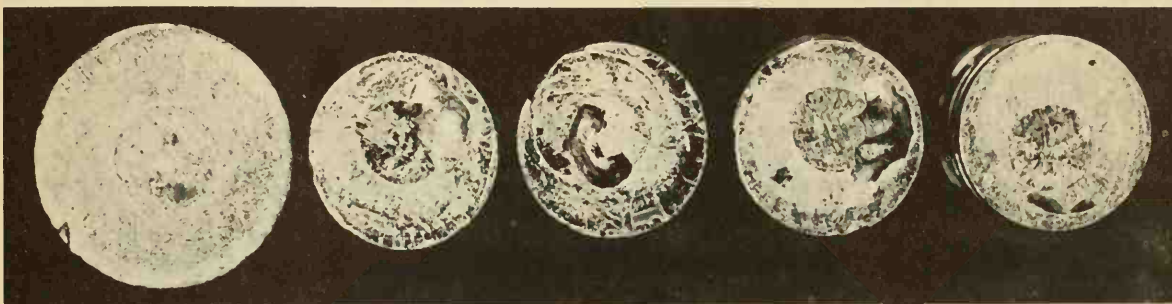


Photo courtesy of Handloader Magazine

Largest bullet has a correctly cast base. All the others show varying degrees and types of cavities that result from poor casting methods.

Holes or cavities in base of bullet: This can be caused by either trapped air, insufficient weight of metal in the dipper (as noted above), or a combination of both. Loosen the cutoff plate and use more lead in the dipper.

Ragged cavity in the base of the bullet where sprue was cut off: Usually caused by striking the cut-off plate before the sprue has fully hardened, and is sometimes accompanied by smearing of lead across the cut-off plate and surface of mold blocks. Make certain the sprue has actually solidified before striking cut-off plate.

Wedge-shaped lump left when sprue is cut off: Make certain underside of cut-off plate is perfectly flat and that edges of the sprue hole are clean and sharp. Loosen cut-off plate screw so that plate swings freely, then strike plate sufficiently hard to cut off the sprue in a single movement.

Band appears to be cracked or slightly separated from body of bullet: Caused by dropping the bullet from the mold before it has cooled sufficiently. One-half of the mold pulls free of the bullet cleanly as the mold is opened, but the bullet remains momentarily in the other and tips as it falls clear. Thus, the bands are slightly displaced. Allow a longer cooling period.

Bullets have crystalline, frosty appearance: Either metal, mold or both are too hot. Reduce heat of metal, and slow down casting until bullet appearance is bright and normal. This can be a particular problem with large, heavy bullets in single cavity blocks. The large amount of molten metal heats the blocks very rapidly, even though lead temperature is held to a minimum. If a satisfactory production rate cannot be maintained, cool the mold by dipping it periodically in lukewarm water (with bullet in the cavity), or by using two molds alternately.

Fins appear on bullet at line where blocks meet: Foreign material is holding blocks slightly apart, or guide pin holes are clogged and causing the same thing. It is also possible that you are relaxing your hold on the mold handles at the time the lead is entering the

mold, allowing the blocks to be forced slightly apart. Clean mold block faces and guide pins and holes, and make sure you keep a good grip on the handle.

Fins on base of bullet: If fins are uniform around the perimeter of the base, the cut-off plate is too loose. Tighten the screw slightly until fins disappear. If the fin is predominately on one side of the bullet base, the cut-off plate is probably warped or bent usually due to incorrect striking of the plate. If the deformation is only slight, the cut-off plate may be removed from the mold and polished flat on abrasive cloth stretched tightly across a hard, perfectly flat surface. The only other solution is a new plate. Once bent, it cannot be straightened satisfactorily.



Photo courtesy of Handloader Magazine

Left bullet has dull, frosty appearance resulting from both mold and lead becoming too hot as work progressed. Right bullet is smooth and glossy, coming from mold and metal of just the right temperature.

Bullets do not drop freely from the mold: Shift the position of the mold as it is opened. If this fails, strike the top of the hinge joint one or two light, but firm, blows with the stick used on the cut-off plate. If more effort than that is required to jar the bullet free, there are burrs in one of the mold blocks, embedded in the surface of the bullet.

With the blocks clean and dry, examine the surface of the cavity under a magnifying glass. Burrs of

sufficient size to cause trouble should easily be seen. Usually, they are small and fragile, and can be very carefully removed with a pointed scraper. Often they are at the outer edge of a cavity, having been produced by the two blocks banging into each other. This type may be safely removed by extremely cautious application of a fine, Swiss needle file. Most authorities advise against any such work on a mold, but there is no other way to salvage a mold so damaged. I feel it is better to at least attempt to correct the condition than to discard the mold without trying. After all, what can you lose?

Air holes inside bullet (disclosed by weighing or sectionalizing): Usually the result of inadequate weight of metal when the mold is filled, resulting in excessive shrinkage with nothing to replace it. Also sometimes caused by too rapid filling of the mold which results in a splashing action that traps bubbles of air. Use more metal in the dipper and fill the mold more slowly.

Irregular, sharply defined small holes in bullet surface: Caused by foreign material in the mold cavity, either falling in from the surface of the mold or being carried in with the molten lead. Keep mold clean, inside and out, and flux lead frequently so that all foreign material floats to the surface, to be skimmed off.

Careful attention to all details mentioned above is not something that you'll be able to accomplish in the first, or perhaps even the tenth casting session. It requires continuous practice and effort over a period of some time. Often you may be casting perfect bullets, then suddenly one or more of the above conditions will crop up for no apparent reason. It's all part of the game. Rest assured, sooner or later it will happen to you. When it does, don't cuss the dog and kick your wife; just analyze the defect and take the appropriate corrective action.

Now, casting a bullet that looks perfect, is uniform in weight, and possesses no internal or external defects still does not accomplish the entire job. The bullet must be cast from an alloy reasonably correct for the job you intend it to do. There are fussy people who keep three, four, or even more bullet alloys available and use each one for a specific purpose. I do not find this at all necessary.

Unless you intend making hard-alloy noses for composite slug gun bullets, a single mix containing no more than 1 part tin in 40 of lead is all you need. For hard noses, make up a quantity of 1-20 mix.

However, we all eventually find ourselves in possession of bullet metal whose contents are totally unknown. More often than not it will be quite soft. I reserve such windfall metal for use in round ball guns. Normally, it is melted up in batches of 25 to 30 pounds, fluxed and skimmed to remove impurities. If skimmed several times without stirring, excess tin and antimony will be removed as it floats to the surface. Then a few

sample bullets are cast from it. If the metal flows well and fills the mold completely, I use it as is. If it gives any casting problems, though, tin is simply added until it flows well enough to produce good bullets. Consequently, I usually have two different bullet alloys on hand — one of more or less unknown content which is soft and used only for round balls, and the other which is of known content and used for more demanding guns.

Once cast, a round ball is ready to shoot, but a bullet might not be. The latter often requires yet two things: Reduction to the diameter correct for your particular barrel and the application of a suitable lubricant in the grooves to prevent leading of the barrel. Bringing it to proper diameter and perfect roundness is called "sizing" and is accomplished by forcing the bullet base-first through a die made for the purpose. Minie bullets must finish up slightly smaller than bore diameter of the barrel in which to be used. Patched bullets, regardless of patch type, must be smaller than bore diameter to allow space for the patch, yet large enough to force the patch into the rifling.

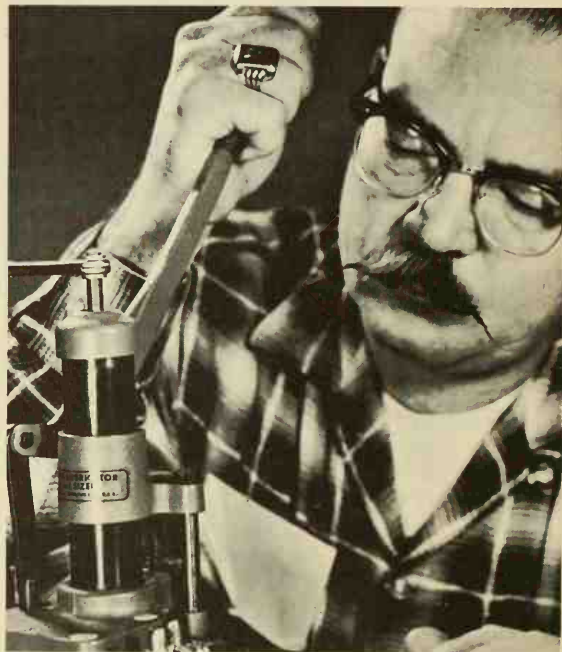


Photo courtesy of Handloader Magazine
Lubricating, sizing too when necessary, is most easily accomplished with the Lyman No. 45 Lubricator-Sizer.

Sizing is required because molds, like all other mechanical contrivances, must be made to certain tolerances. They often cast a bullet somewhat larger than the desired diameter. While it has been said that sizing

always damages a cast bullet to some degree, damage can be held to a minimum by using the proper type die. Older dies were made with a two-diameter hole — the upper portion to accept the as-cast bullet, the lower of the size to which it was desired to reduce that bullet. These two holes were connected by a sharp shoulder or a sharply tapered area.

Such dies shear metal off one side or the other of the bullet bands, yet do not touch the bottoms of the grooves. This simply means that a bullet so sized is more often than not thrown out of balance and may not be expected to produce best accuracy. More recently produced resizing dies connect the two holes of different diameters by a long, very gradual taper. This longer taper does not remove any metal from the bands, but rather compresses the bands in a reasonably concentric manner. Bullets sized in the newer dies are generally more accurate. In any event, the less reduction, the better.

The lubricant may be applied either before or during sizing. Fewer tools are required for the former. Lube may simply be rubbed into the grooves by hand (a most time-consuming process) or the bullets may be stood in molten lubricant that is then allowed to harden. After the lubricant is hardened, a fired cartridge case with the head cut off, or a length of tubing, may be pressed down over the individual bullets to cut them free from the cake of lubricant.



Typical Minie bullets that have been lubricated by smearing grease in their grooves by hand. When sizing isn't required and not too many bullets must be processed, this is a quick and easy way to get the job done.

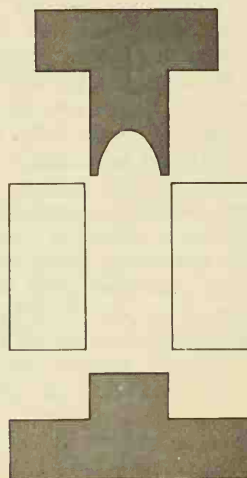
Either way is entirely satisfactory. However, by far the simplest and most convenient method is the use of a lubricator-sizer machine of the type sold by SAECO or Lyman Gun Sight Co. This device combines lubricating and sizing into a single operation. The bullet is placed in the mouth of the sizing die and is then forced down into the die by means of a handle and nose-fitting punch. When the bullet reaches the limit of its downward travel in the die, it has been fully sized and its grooves are aligned with passages leading to a lubricant reservoir. A ratchet handle then exerts pressure on the lubricant in the reservoir, forcing it into the grooves in the bullet. Reversing the movement of the handle then lifts the bullet back up out of the die and it is ready to use.

Lubricating and sizing is not so simple that it doesn't require considerable attention to detail. The nose-punch which forces the bullet into the die must fit the bullet, and it must also be aligned correctly with the die. If it is not, then the bullet may be forced through the die somewhat canted resulting in the appearance shown in the accompanying photographs. Such a bullet is sized off-center and along a line not parallel to its longitudinal axis. Consequently, it may be badly out of balance and grossly inaccurate.

Of course, it goes without saying that perfect bullets, perfectly sized and lubricated, must be kept undamaged until they are loaded and used. If lubricant is allowed to be contaminated with dust and dirt, or grit is allowed to collect on the bearing surfaces of the bullet, less than perfect results may be expected. Also, if the bullet base is damaged in any way, accuracy will be reduced. I find it best to store prepared bullets stacked closely on their bases in covered boxes. This protects them properly until use. Because of its soft nature, a lead bullet must also be seated and rammed carefully in the rifle, or it may become damaged in the process. Seating punches should fit the nose correctly, as should the ramrod head.

Bullets are seldom swaged by the shooter except for use in slug guns. Swaging consists of compressing the cast bullet in a die to eliminate all voids or air spaces and to bring it to a greater perfection of shape and surface finish than can be produced by the mold.

The die body contains a polished cylindrical cavity of the diameter to which the bullet is to be produced. Close-fitting punches enter the cavity from both ends. One forms the base, be it flat, rounded, or containing a cavity. The other is shaped to form the bullet nose, which is usually gently rounded with a flat tip.



The bullet swage in its most basic form consists simply of a die body and close-fitting shaped punches for base and nose.



Swaged bullets may be solid or two-piece as is this one intended for a slug gun. Nose portion is hard to resist deformation during ramming, body soft to take the rifling easily.

The bullet is cast slightly undersize, lightly lubricated (case resizing lube or lanolin works very nicely) and placed in the swage. Both punches are inserted; and, in normal slug gun practice, the assembly placed on the bench, base punch down. The nose punch is struck several times smartly with a hammer. The bullet is compressed between the two punches and expanded radially to fill the die cavity perfectly. All surface imperfections are ironed out, and all internal voids eliminated. The result is a perfectly homogenous bullet. Bullets are forced out of the die by a separate close-fitting punch.

Diameter of bullets so swaged will be very uniform, but weight will remain as cast and length will vary with relation to weight. By providing a positive, adjustable stop for the nose punch and drilling an escape vent in the die, bullets of surprisingly uniform weight and length can be produced. To do this, bullets are cast very slightly overweight and swaging pressure then "bleeds" excess lead through the vent. When the nose punch strikes its stop, no further pressure is exerted in the bullet and the desired weight and length is produced. The excess lead forced into the vent remains attached but is sheared off as the bullet is forced from the die. Bullets varying no more than ± 0.2 grains in weight can be produced in this manner.

While "hammer-swaging" as outlined above is the most common, the job is simpler in a heavy-duty vise. However, the only method by which the pressure applied can be closely controlled, both in amount and rate of application, is by use of a hydraulic press. Theoretically, this will produce the most uniform bullets. In practice, however, shooters develop an "educated hammer hand" that turns out surprisingly uniform bullets.

Composite slug gun bullets are cast in two parts — a pure lead body, and a hardened alloy nose. A tenon on the nose fits into a cavity in the body, or vice versa. The parts are pressed loosely together by hand, then swaged as already outlined.

Some shooters go a step further in attempting to produce bullets as homogenous as possible. The cast slug is laid on a clean, smooth steel plate and pounded with a hammer. A roughly cylindrical shape is retained, but the lead is thoroughly pounded to close any voids it might contain. I frankly cannot see any value in this treatment, since proper swaging accomplishes the same end — but some match winners swear by it. It's hard to argue with success.

Swaged bullets can be produced without casting, and I prefer this method. One simply obtains extruded lead rod or wire of a diameter small enough to enter the swage body freely. Slugs of the correct length and weight are cut from the rod and placed directly into the swage. Much simpler than casting the slug. This system has the added advantage of allowing any reasonable variation in weight to be made by changing slug length. When cast slugs are used, one needs a separate mold for every weight. Extruded lead wire or rod is virtually free of voids, something that can't be said for cast slugs.

Swaging dies are normally furnished by the rifle maker. However, any competent gunsmith or machinist can make them without difficulty. Die body and both punches must be very carefully polished, then hardened, then lapped to a "slip" fit. If not hardened, the punches will upset and stick tightly in the die. If not fitted very closely, they will allow lead to extrude between them and the die. This is particularly bad at the base of the bullet since it is especially difficult to trim such "fins" off and preserve a perfectly square base. The bullet "knock-out" punch must also fit snugly or the same thing will happen.

Obviously, swaging can be applied only to ungrooved bullets. This limits swaging to paper patch type bullets. In addition to the slug gun, you may have a breech loader chambered for one of the obsolete black powder cartridges that used lead bullets with wrap-around paper patches. Exactly the same swage design and operations can be used to produce this type.



Typical Minie bullet with its large base hollow which causes the bullet to be expanded by powder gases to engage the rifling, while still being small enough for easy loading through the muzzle.

Chapter 11

SIGHTS

The muzzle loader, be it common rifled musket or the finest bench-rest slug gun in the country, is no better than its sights. Traditional on the hunting or military rifle is the V-notch open rear and brass blade front sight. And, make no mistake about it, the boys do some really fine shooting with this combination. You'll see more open-sighted guns than any other at muzzle-loading matches around the country. That doesn't mean those original sights are by any means the best to be had.

During the black powder era, a great deal of sight development took place. All this has been covered in this author's "Gunsight Guide," published by Shooter's Bible, so we'll not go into it too deeply here. If you really want to dig into sight development, from cannon lock to present, latch onto a copy of that book.

Needless to say, if you're really interested in shooting, you want maximum accuracy — and that means modern sights, at least where match rules don't prohibit them. However, keep in mind that many sight installations will require drilling and tapping or other alteration of the gun. That's okay if a modern muzzle loader is being used, but such shenanigans can greatly depreciate the value of an original gun.

A look at the original guns first. Hunting models will normally have a simple one-piece rear sight dovetailed into the barrel ahead of the breech. There will be no vertical adjustment, and windage can only be obtained by driving the sight sideward in its dovetail. The sight will be low and have a simple V-notch filed in its upper edge. Military sights will have a sliding leaf and elevating steps, though, the steps are usually of some indeterminate value, even when marked for specific ranges.

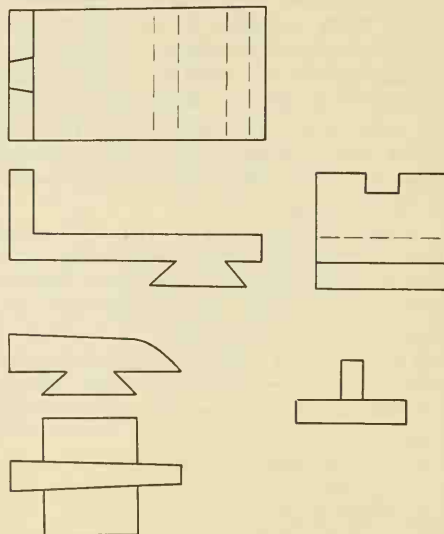
The front sight will be a one-piece rounded brass blade — the poorest possible shape — also dovetailed into the barrel.

The V-notch and rounded blade may be fine for snap-shooting in darkened, primeval forests, but sunlight bouncing off that shiny brass can shift the center of impact several inches at 50 yards. If you must keep and use the original sights, smoke them dead black

with a candle stub or carbide lamp. This will help a great deal, even though sight shape is lousy.

To improve the situation, the original sights may be carefully removed, and new ones made to fit the original barrel dovetails. Use a soft drift and light hammer to tap the old sights out from left to right. Take care not to damage either the barrel or sights. Save the sights, then the gun can be restored to original condition and value whenever you wish.

Since the original dovetails were most likely hand-filed, they'll not accept any standard sights. You'll have to whittle new ones to fit from solid stock. Use hack-saw and files to cut them to the shapes shown. Leave the tops well oversize, while fitting the dovetails very carefully. If the sight dovetails are made too large, the barrel dovetails will become enlarged and won't hold the original sights securely again.



New rear (top) and front sights can be filed to these shapes and fitted into the old dovetails. These particular shapes are considerably better than the originals.

After fitting the dovetails, shape the front blade and rear leaf, but leave them higher than you want. Make certain the rear face of the front blade is square and the rear leaf is perpendicular to the bore centerline. Align the two sights over the bore centerline as perfectly as possible.

Now you can file the front sight down to approximately the desired height. Carefully file the square notch, centered in the rear sight. Make it just wide enough to allow a thin line of light to be seen on either side of the front sight. It need not yet be filed full depth — that can be done in conjunction with zeroing later — just deep enough to line up the front sight with the gun at your shoulder.

A good bit of shooting can be avoided if the breech plug is removed and the gun is bore-sighted at this stage. Clamp the barrel in a padded vise, pointed at a target about 100 yards distant. Almost any kind of target, even the top of a fence post, will do. Check horizontal sight alignment on the target. Drive the rear sight sideward in its dovetail to correct any errors.

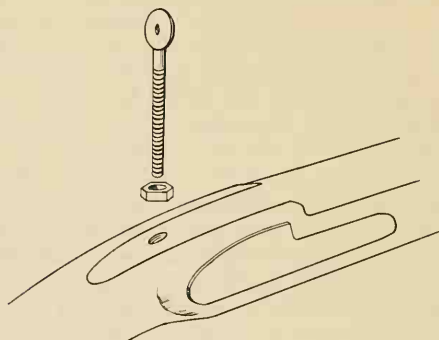
Now, file down the top of the rear sight, deepening the notch accordingly, until the sights are aligned on target a few inches lower than the bore. This difference compensates somewhat for bullet drop and simplifies zeroing, even though it can't be calculated precisely. Assemble the gun and shoot it in at the desired range. Fifty yards is a good zero range. Final windage adjustment is made as you shoot, by tapping the rear sight sideward. Make final elevation adjustments by filing down the top of the rear sight to lower point of impact, by filing down the front sight to raise it. Once zeroing has been accomplished to your satisfaction, true up the edges of the sights and clean up the rear sight notch. If it needs deepening or widening to suit your particular tastes, do that now. Don't make the mistake of making the notch too wide, thus, allowing too much light to show on either side of the front sight. Tapering the edges of the notch, toward the rear, and the front blade toward the front will reduce reflection and produce a sharper, blacker image.

The completed sights can be removed and blued or browned, or touch-up solutions can be used to finish them in place after polishing. Don't leave them bright or they'll rust. If they are removed, be sure to make index marks on barrel and sights. If this isn't done you'll not get the sights back in the same locations and will have to re-zero. Such sights won't spoil the appearance of an original gun, and they will certainly improve your scores.

Of course, the same procedures can be used on a modern muzzle loader if you aren't satisfied with the sights that come on it.

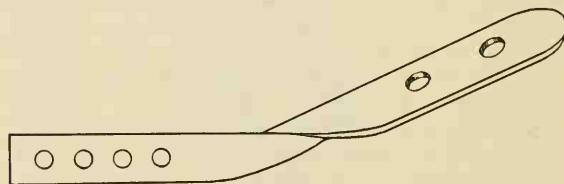
Original sporting and target rifles were often fitted with an aperture rear sight mounted on the tang. Such sights were usually made adjustable only for elevation by screwing them in and out of a vertical hole in the

tang, or by sliding the eyepiece up and down a staff. The simplest form of this type sight is just a piece of threaded rod turned vertically into a hole in the tang, and containing an aperture at its upper end. A modern muzzle loader can easily be drilled and tapped for such a sight, but to do so on an original gun wouldn't be a good idea.



Some early rifles were fitted with a simple tang aperture sight as this. Elevation adjustment is obtained by screwing the threaded stem in or out of the tang, and then locking it in place with the jam nut.

An alternative exists and it works equally well on old or new guns. It doesn't require that they be permanently altered. Redfield Gun Sight Co. makes a "Muzzleloading Adapter" to which can be screwed a modern micrometer-type receiver sight adjustable for both windage and elevation. This soft steel adapter is attached atop the tang by means of a new, longer tang screw (which must be custom made). The adapter is drilled and tapped to accept standard receiver sights and may be bent cold to position the sight as desired, as well as, to fit the curve of the tang. If the original tang screw is kept, the gun may be restored to original condition at any time. No evidence of the sight installation will remain. This sight adapter also has the advantage of placing the receiver sight back near the shooter's eye where it is most efficient.



An adapter for modern target sights can be made by selecting a piece of bar stock which is first bent to fit the tang. It is then twisted to form a vertical surface to which the sight can be screwed. Redfield sells such an adapter ready for use.

When any form of aperture sight is added to your muzzle loader to improve its accuracy, a new and better front sight is in order. Generally, a higher front sight is required since adjustable rear sights sit higher above

the bore than the originals. The simplest form is a plain, straight blade fitting the original dovetail. Make it as already outlined, but as high as the rear aperture is above the bore. It can then be filed down for bore-sighting and zeroing.

If you're really serious about getting the best target sights available, interchangeable-insert, target-type front sights are readily available. Of course, they are made for modern cartridge arms, but this doesn't lessen their effectiveness on muzzle loaders. Both Redfield and Lyman make good models. Fitting them requires either a new transverse dovetail or a mounting block to be secured to the barrel. There isn't any way to do this except by drilling and tapping holes in the barrel, so think hard on it before doing so to a good original gun. Such sights may be fitted to an original gun without altering it by making a split clamp-ring to fit the muzzle, then attaching the sight to this ring.

The combination of a Redfield or Lyman receiver sight and target front sight with interchangeable inserts is probably the best to be had for paper-punching. It can even be used for hunting if a plain post front insert is used. It offers the advantage of being readily adjusted to zero for any powder charge or bullet change you might want to make. Fixed open sights force you to take Kentucky windage and elevation when any load charges are made and that's not the best way to shoot "possibles."

Bench-rest guns, be they for slug or round ball, are often fitted with scopes. Even some better quality sporting guns carried scopes. An occasional original example will be seen with a contemporary scope, but modern instruments of up to 20X are by far the most commonly used. They are target-type scopes in adjustable mounts, attached to the rifle barrel by screwed-on longitudinal dovetails. Mounting them correctly is a job for a competent gunsmith. It isn't something to be undertaken with hand tools on the kitchen table.

Now and then we see a muzzle-loading rifle fitted with a modern scope and used for hunting. The late Al Goerg, a well-known hunter with muzzle loaders, fitted a regular hunting scope on his Navy Arms Zouave .58 caliber rifled musket and killed a variety of big game with it. A Weaver scope and mount base can be attached directly to the barrel ahead of the hammer. The mount base must be chosen to match barrel radius to obtain a solid installation. Octagonal barrels present no problem at all since most mount producers make flat-bottomed bases. They can be installed with no fitting or filing. Since muzzle loading barrels are often rather thin-walled, care must be taken in installation. Don't let the screw holes run into the bore. If the mount base is carefully fitted to barrel contour, it can be attached with solder or epoxy cement, thus, eliminating the need for screw holes.

Actually, with a little ingenuity, you can fit almost any type of modern sights to a muzzle-loading rifle.

Standard models aren't made to fit such guns, but by careful selection, you can come up with sights that can be made to fit without too much trouble.

Front-loading handguns present no great problems. Single-shot pistols and solid frame revolvers can be easily fitted with modern target sights. If the barrel and frame are thick enough, dovetails can be cut to accept new sights. If there isn't enough metal to allow a dovetail to be cut safely, then a base block can be sweated or screwed in place, and the sight installed upon it. Original sights on single shot pistols can be given the same treatment outlined earlier for rifle open sights.

Open-top frames like the Colt percussion revolver leave no proper place to install a target rear sight. I've seen this tackled two different ways. The first consists of simply fitting the rear sight on the rear portion of the barrel and accepting the loss in efficiency that results from placing it so far forward. The other consists of attaching a bar to the rear of the barrel, extending back over the cylinder. The rear sight is then installed on this bar in the normal relationship to the cylinder. Properly fitted, such a bar does not interfere with functioning or disassembly of the Colt design, though it does look a bit odd. A collector will scream and foam at the mouth at the sight of such an installation on an original gun.

The original Colt sights aren't worth much. The V-notch in the hammer nose is better than no sight at all — but not much. It can be improved by reshaping the notch, but is still a wobbly affair that does very little for accuracy. The simplest improvement consists of an L-shaped square-notch rear sight bent from sheet metal and screwed or soldered to the upper rear of the barrel. Dovetailing a similar solid sight in place looks better, but takes a lot more time and effort without producing a corresponding increase in performance.

Solid frame revolver rear sights can be improved by filing the notch to square shape. Even better is a new sight fitted to the top strap. It may be the type just mentioned or, if you want to go all-out, use a target-type sight.

Almost any rear sight improvement requires a new front sight. The cone or pin sights on many caplock revolvers are really not of much value, particularly when they are of shiny brass. Dovetailing a new properly-shaped sight into the barrel is the best approach. It should be made and fitted as outlined for rifles. If an adjustable target rear sight is being installed, by all means include a matching front sight of the same make. My favorite "shooting" Navy Arms Remington .36 replica is fitted with Micro front and rear target sights and will out-perform a good many modern cartridge revolvers when carefully and properly loaded.

In the final analysis, it's the results on target that count — but you need top-notch, modern-style sights in order to extract the accuracy built into your barrel.

Chapter 12

ACCESSORIES

Like the cowboy with a ten-dollar horse, fifty-dollar boots and hundred-dollar saddle, the muzzle-loading shooter soon find himself swamped with accessories. We all know it's entirely possible to own and shoot a rifle with nothing more than ammunition.

But life would be pretty dull and prosaic that way. Sort of like having only Scotch at the bar. Accessories not only make shooting easier, faster, and more fun, they give a fellow more room in which to display his initiative and knowledge of the game. Better yet, many of the standard accessories can be made with only hand tools — and mama will appreciate your having something to keep you off the streets.

Let's take a look at the items you'll eventually collect to go with your front loader.

Nipple Wrench	Priming Horn
Nipple Prick	Wiping (cleaning) Rod
Ball Starter	Breech Cover
Patch Knife	Nipple Protector
Loading Block	Hunting Bag
Capper	Rifle-Loading Bracket
Powder Horn	Handgun-Loading Stand
Powder Flask	Patch Cutter
Powder Measure	Gun Case

Authentic Costume

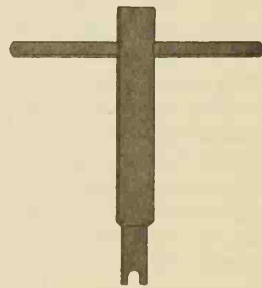
The list may never be completed because someone will always think of a new gadget we just can't afford to be without. But what are they good for? Why do we need them and, what is more important, how can we make them ourselves to avoid stealing from the grocery money?

Any time you go out to shoot you need, in addition to ammunition and ramrod, a NIPPLE WRENCH. This is one item you won't make on the kitchen table. It's used to unscrew or replace the nipple and must fit that part very closely. It comes in all forms, but most common today is the T-handle type. Sure you can buy cheap ones, but they'll be soft, poorly machined, and poorly heat treated. They will bend and twist on the first tight-stuck nipple encountered. In an emergency,

you may be able to use a very small adjustable wrench (crescent) if on a long gun where there is plenty of clearance, but it's easier to carry the proper wrench — and don't forget spare nipples.



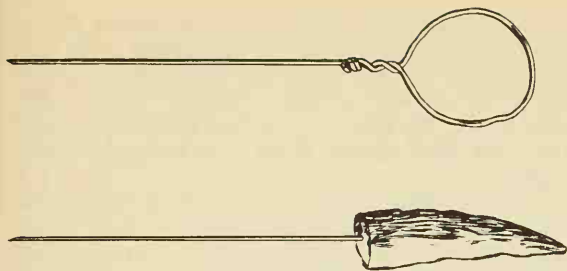
Where there is sufficient room to get a conventional open-end wrench on the nipple plate. This type works well. It can be made by filing or grinding from flat tool steel stock, or by reshaping a hardware-store wrench of the proper size.



The T-handle nipple wrench will work in the closest quarters but lacks leverage and requires careful heat treatment if it is to hold together on tight nipples. I'd not try to make this type.

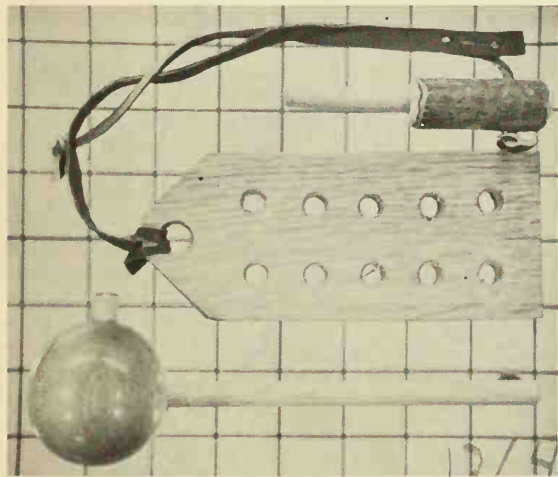
A NIPPLE PRICK is probably the easiest accessory to make. Go to the nearest model shop and get a short length of piano wire that will just pass through the nipple. For a flintlock, the same instructions apply, but fit it to the flash hole.

Make a comfortable handle of horn or hardwood and drill a tight hole to accept the wire. Force a length of wire into place. Cut it off, leaving about $\frac{3}{4}$ " — 1" sticking out and polish the end smooth and round. Nothing more is required. To clear the flash hole, simply run the wire through, pushing out fouling and debris.



A nipple or flash hole prick is nothing but a piece of stiff (preferably spring-tempered) wire that can be forced through the hole to clear out debris. It can be either plain or fancy as shown here, but it is quite simple to make in either case.

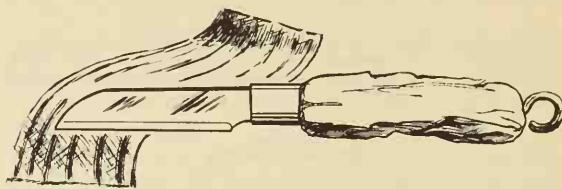
Any long gun other than the rifled musket and shotgun requires some sort of **BULLET STARTER**. Once the ball is centered on the patch, it must first be pressed just below the muzzle so the patch can be cut off. Then it needs to be shoved several inches into the bore so the ramrod can be used. A seater for this purpose is easily made from scrap hardwood. Whittle a rough ball that fits your hand comfortably, then drill two holes in it at right angles. Carve out a pair of short pegs just under bore diameter — or use commercial dowel — and glue them in the holes. Trim one very short, perhaps 1/4" to 1/2" long, and hollow its end to fit snugly over the ball. Trim the other to 1-1/2" or 2" and give it the same treatment. Give the completed starter a good coat of oil or stock finish, drill a hole through the ball, and string it on a thong for hanging round your neck or tying to your outfit.



The simple, two-legged ball starter shown here is quite easy to make. Also shown is the simplest form of loading block.

A **PATCH KNIFE** is essential unless you will *always* use pre-cut patches. And, that is not likely. The best knives are made with slightly curved blade sharp-

ened on the inside of the curve. The edge is formed by beveling only one side of the blade leaving the other flat so as to slide smoothly across the muzzle.



A patch knife is a necessity and blade should be beveled on one side only as shown here. The blade can be ground out of a piece of saw blade with little trouble.

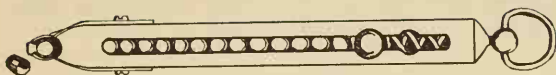
Actually, any sharp knife will do for cutting patches. Old straight razor blades work very nicely. The accompanying drawing shows a patch knife easily made from a hacksaw blade in a few hours time. The handle may be of any material, but the horn blanks available from Dixie Gun Works suit me best.

The rifle can be loaded faster by means of a **LOADING BLOCK** than by any other method. Our drawings show how simple this gadget is — a flat piece of hard wood (I like maple) with a row of drilled holes that fit patched balls snugly. On one side the holes over the bore. Strung on a thong, the loading block can be carried around your neck.

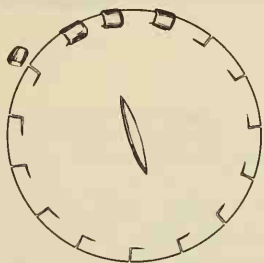
In use, one simply seats patched balls in each hole just as in the rifle muzzle. Then, to load, the block is slipped over the muzzle and the long leg of the starter is used to drive the ball from block into barrel. This can be speeded up by stringing the starter to the block. The loading block may just as easily be of horn, metal, or plastic, but wood to match the gun's stock seems more appropriate.

A **CAPPER** may look like a complicated gadget — more trouble than it's worth. And, one that doesn't work will have you cussing a streak. Essentially, it's just a magazine for caps. An opening in one end exposes a single cap. Slip that cap down over the nipple, a twist of the wrist, and drop the capper back in bag or pocket. It's so much less trouble than fumbling in bag or pocket for loose caps, or trying to remove the lid from a tin box. Once you've tried a capper, you'll never want to be without it. They come in a variety of sizes and shapes, and to fit either plain or musket caps.

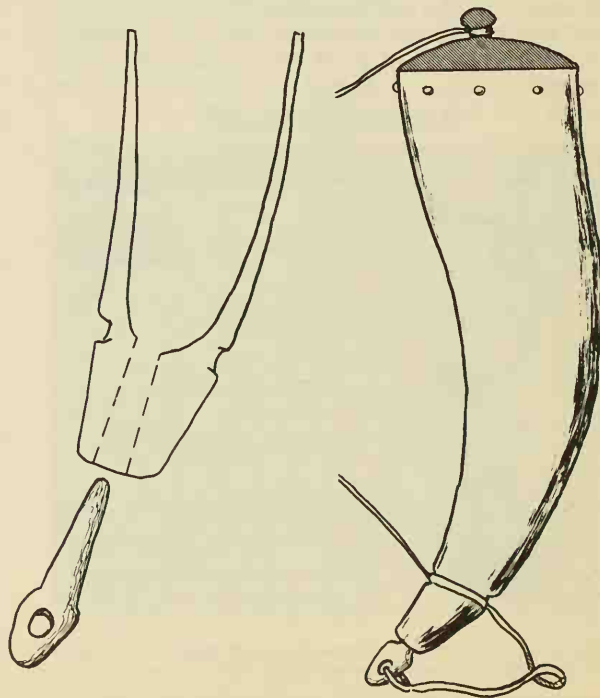
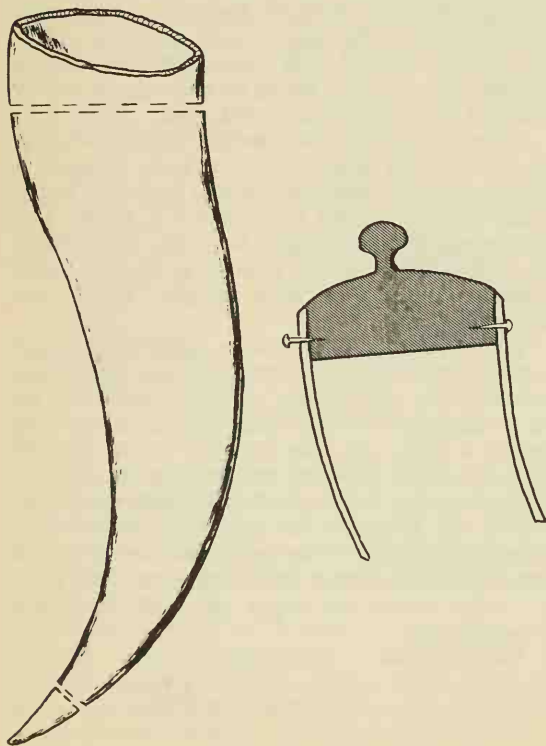
You *can* make a simple capper. Bend a sheet of thin brass into a square tube just big enough for free passage of the caps you'll be using. Slot and shape one end so that a cap sliding down will be held there, yet can be pulled free after being pressed over the nipple. Place a plastic follower block and *weak* coil spring in the tube and close the other end.



The simplest form of true capper is this square tube fitted with a spring and follower and cut at the end to allow caps to be slipped in and out. Requires rather careful work to make.



Far simpler to make is this cap holder, and it is almost as handy as a capper. Simply cut the disc out of heavy leather, and then make L-shape cuts around the circumference. If the cuts are made right, caps can be slipped in or out easily, yet will stay in place without a bit of trouble.



Making a powder horn is quite simple, but time-consuming. The steps shown here (left to right) are all that is needed to turn out a perfectly serviceable horn in a couple of evenings.

The POWDER HORN was in its heyday during the tenure of the flintlock. When caplocks came into use, though, the patent charger flask became pretty much the accepted powder container. Today, every front-loading fan seems to prefer the horn, even though flasks are much simpler to use. The horn adds color, I guess.

Several outfits supply new horns ready for use, but this is one item many shooters prefer to make themselves. Raw cowhorns can sometimes be obtained from farmers, ranchers, or slaughterhouses, but it's far simpler to order what you need from one of the mail-order suppliers.

That stinking, cruddy-looking horn can be turned into as fine a powder carrier as you'd like, but it's going to take some work. First, it must be boiled to loosen the core and soften the shell. Unless you've a very temperate and broadminded wife or housekeeper, do this outside — and downwind from the house. It will stink! After cooking, rap the open end on a hard surface and the core will pop out. With knife or glass, scrape the outer surface of the horn to remove the rough skin. Don't worry about getting it real smooth, just remove the outer layer completely.

Poke a wire up into the hollow, measuring to its end. Mark the end on the outside of the horn, then saw off the tip about 1/4" or 1/2" past that point. Use a fine-tooth hacksaw for a smooth cut. Save the cut-off tip. Drill a 1/4" or 5/16" hole into the hollow, centered in the cut-off face. With a round file and scrapers, taper this hole slightly, then carve a hardwood plug as shown to fit it snugly. The plug can be made perfectly plain, with just a knob or grip, or you can get real fancy. Some shooters prefer to make the plug from horn.

Trim off the large end of the horn squarely. The horn won't be very smooth inside so you can, if you like, now use scrapers, files, and knives to make it smooth. Don't make the walls too thin near the opening, or securing the base plug may be a problem.

Carefully shape a plug to fit the open base. It may be turned on a lathe, but the out-of-round opening may require boiling to soften in order to fit the plug. With the plug in place, secure it by driving in a ring of brass nails or small brass screws. Drill small pilot holes in both horn and plug to prevent splitting.

The outside of the horn may now be left plain if you like. If so, carve a shallow groove around the neck and tie a thong there to which the plug can be secured. Then another long thong or carrying strap at the same place, and again at the base plug.

The cut-off horn tip should now be drilled with a cavity to hold just the proper charge for your pet rifle. Then drill a crosshole through its end and loop a thong through. Secure it to the horn-carrying strap.

Much of the charm of older plain horns was due to the fact that they had been scraped almost paper-thin, then polished to a high gloss. This rendered them somewhat translucent and the powder level could be seen by simply holding them up to the light. This was for practical, as well as aesthetic reasons, since it made the horn lighter and smaller.

You can attain the same results by slow, careful scraping and sanding. Care must be taken to keep the wall thickness as uniform as possible. An old plane blade or saw blade makes an excellent scraper, but broken glass will do fine if carefully handled. When the walls are thin enough to suit you, cross-polish in bootblack fashion with strips of fine abrasive cloth. This will remove all scraper marks. Then wet-sand with the grain of the horn to remove cross-polishing marks. Finish up with the finest grit wet-or-dry paper you can find. Final polishing is best done on a soft muslin wheel, but lacking that, rotten-stone and oil rubbed by hand will do the job — it just takes many times longer. A felt pad charged with any very fine abrasive also works well.

That's the plain, traditional horn. Maybe you'd like a horn with a charger spout like those on powder flasks. No problem. Simply obtain a flask head from a supplier such as Dixie Gun Works, and then choose a

raw horn that can be cut to fit as shown.

Measure head and horn carefully and saw off the latter squarely at a point where the head can be fitted snugly in place. Actually, the horn walls will be thick enough to allow considerable handfitting. The horn may have to be boiled to soften it, then rounded by driving in a wood plug of the proper diameter. When cold, the horn will hold its new shape and the head may be easily fitted.

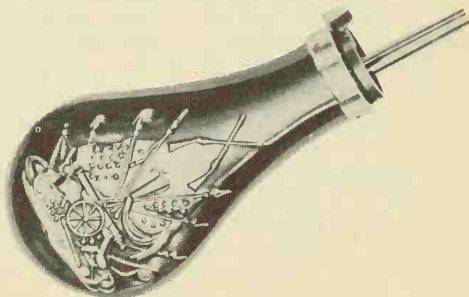
With the head carefully seated in the horn, drill and tap holes for the securing screws. Use at least four screws or, better yet, six. If you're lazy, use epoxy cement. To be real high-class, thread both head and horn, and then screw them together.

Flat pocket horns are sometimes more convenient and aren't hard to make. Select a horn that curves only in one direction (no twist) and boil until very soft. Place it between two stiff, flat boards and compress it in a heavy vise until the horn is as flat as desired. If a big enough vise isn't available, use large C-clamps or weights to apply the pressure.

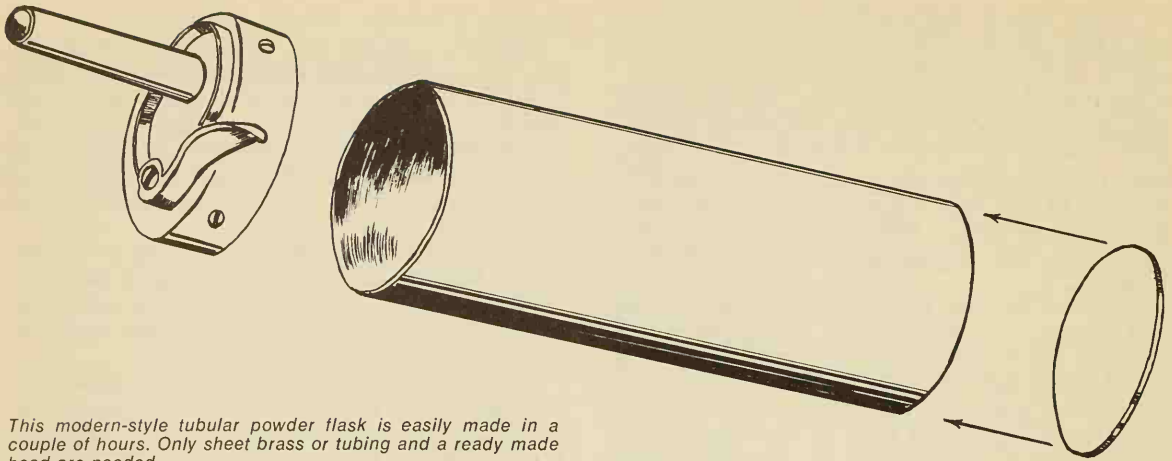
Leave the horn under pressure until completely cold and dry. If taken out too soon, it will assume some of its original shape. Once the flattened shape is achieved, all other steps remain the same. I particularly like a small, pocket-size flat horn for flintlock priming powder. Incidentally, percussion caps were once carried in small horns with a mouth just large enough to let one cap out at a time.

A powder horn can be decorated in a number of ways. The most common is carving or burning one's name or simple designs upon it. We leave this step to your imagination and initiative.

The POWDER FLASK with charger spout is the most convenient way I know to carry powder ready for use. Both modern designs and reproductions of traditional measures are readily available, but it's fun to make one. If you're real handy and have a well equipped shop, you can make the whole works. But, we prefer to buy the charger head, then make the body and put everything together.



The traditional form of powder flask shown here could possibly be made at home (sans decoration), but would be more trouble than it is worth when it can be bought at a reasonable price from a number of sources.



This modern-style tubular powder flask is easily made in a couple of hours. Only sheet brass or tubing and a ready made head are needed.

The simplest design is the tubular or cannister body shown. Obtain brass or copper tube of a diameter to fit the head and cut it to length. Solder or rivet in a base disc, then attach the head with screws or solder. Epoxy cement will do as well, but it seems too modern to use on a powder flask. Such a flask can be ornamented by cutting designs out of matching or contrasting metal and soldering or riveting them in place. Eagles and bears look good. If tubing of the proper size isn't handy, roll sheet metal into a tube and solder or braze the seam. A carefully-done lap joint can be "feathered" with a file so as not to break the smooth radius of the tube.

Other flask shapes can be made, but require more patience than I possess. A female die of the shape you want can be carved in a hardwood block. Very soft, rather thick copper sheet can then be carefully pounded into the shape of the die. Two halves are produced this way, then trimmed and soldered together to form the body. I haven't done it, but this is what I'm told by fellows who have.

Some sort of MEASURE is necessary to get the right powder charge into your gun. Naturally you can't just pour from the horn and get the same charge twice. One of the simplest measures is a large-caliber center-fire cartridge case shortened to hold the right amount. More in keeping with tradition is the cowhorn tip hollowed out as previously described. A simple adjustable measure can be made from any convenient piece of tubing. A sliding plug is made to fit inside it and is held in place by a setscrew. Ideal are the adjustable metering chambers furnished with Belding & Mull and Redding-Hunter standard powder measures. They are sturdy tubes fitted with threaded plugs and jam nuts.

Good muzzle-loader CLEANING RODS — wiping sticks — aren't easy to find. I prefer a very stiff, sturdy rod of hardened steel. Traditional wood rods and light metal ones pick up grit and dirt and often bend enough

to rub on the bore. Soft iron barrels of some guns can be badly worn in this way.

The best rod is a length of hardened ground drill rod, drilled and tapped at one end to accept standard accessory tips. The other end should be fitted with a ball-bearing swivel handle. An old roller skate wheel makes a good handle. Thread the end of the rod and run a lock nut on it. Add the wheel, then another lock nut, and clamp the inner portion of the wheel tightly between the nuts. This leaves the rim of the wheel free to rotate independently of the rod. The handle may be used as is, but is improved by addition of a hand loop bent from 1/4" or heavier rod. This can either be welded or threaded in place.

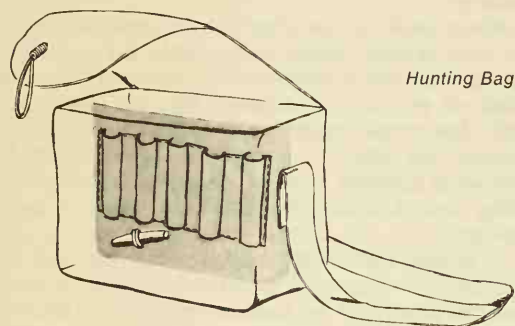
A BREECH COVER isn't seen too often. One type is a leather hood that completely encloses the hammer and nipple area. Its purpose is to keep rain, snow, and dust or dirt off that part of the gun. If you're hunting in lousy weather, such a cover can prevent misfires. It is made as shown in the accompanying drawings. Pulling the securing thong allows it to open up and fall clear of the lock instantly.

The other type covers the barrel and stock in the vicinity of the nipple which sticks up through a hole. This cover's purpose is to prevent flame, cap fragments, and powder fouling from scarring up the wood and metal near the nipple. This gadget is simply a strip of leather laced over barrel and stock, containing a hole through which the nipple protrudes.

NIPPLE PROTECTORS serve two purposes and a good one can be whipped into shape in a moment or two. A piece of fairly thick (not sole thickness, though) leather is shaped as shown — sort of a "dumb-bell" shape. Punch a hole in one end to slip tightly over either the nipple itself or the hammer nose. To perform its function, the solid end of the leather strip is placed over the nipple and the hammer lowered full upon it.

This protects the nipple in storage or carrying and also seals the nipple passage tightly as mentioned in the various loading instructions. Another type of protector can be made in the form of a snug-fitting brass or copper cup that fits over the nipple. It may be attached to a screw or staple in stock or lock plate by a length of small chain.

A HUNTING BAG somehow seems to make a fellow feel better equipped for muzzle loading afield. It isn't that all the shooting paraphernalia can't be carried on your person or in your pockets, it's just that the bag "fits" with the gun. There are a few places you can buy a ready-made bag, but the one shown in the accompanying drawings can be put together in a single evening.



Hunting Bag

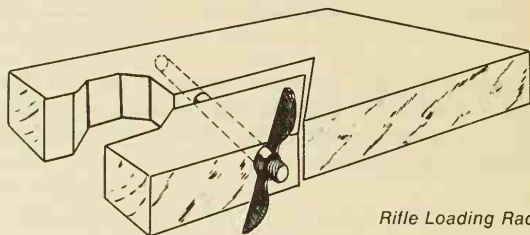
Most commonly used bag material is buckskin, but calf tanned with the hair on also looks rather nice. The choice is yours, and even canvas isn't bad. Simply cut the pieces as shown in the drawing and sew them together. If you want to be real frontiersy, punch holes with an awl (which was a vital part of every mountain man's gear) and do the job with thin thongs. A more practical approach is to have the local shoe repair shop do the job on a sewing machine. Don't try it on your wife's machine or you'll break a needle and upset her. Attach a closing strap and a shoulder strap — the basic job is done.

The hunting bag must be plentifully supplied with pockets. You can carry everything loose inside if you like, but fumbling for just the item you want will add new words to your profane vocabulary. All this can be avoided by sewing loops and pockets on the inside for: nipple wrench; nipple prick; patch knife; can of extra patches; balls; capper or can of caps; ad infinitum. When you're finished, there'll be a place for every item and you can grab what you need in an instant.

They can wind up as fancy as you like. We've seen some that were completely covered with beadwork in Indian style — representing a year's spare time work. They were pretty, but even so, the simple buckskin outfit you put together in a single evening will be fully as convenient.

Should you become interested in bench-rest shooting with either slug gun or round ball rifle, you'll get highly irritated the first time the gun tumbles to the ground as it's being cleaned or loaded. If the gun gets damaged or the sights are knocked out of line, you'll really scream. If you simply lean the gun against the bench sooner or later you'll be picking it up off the ground.

Yet, this is easily avoided. If you use a portable bench and carry it to range and matches, it can be notched or pegged to provide a secure place for the rifle. But, even this won't insure that the gun won't skid away and fall while cleaning or loading. I much prefer a **LOADING CLAMP** which grips the barrel tightly enough to keep the gun in place even if some clod kicks it as he walks by.



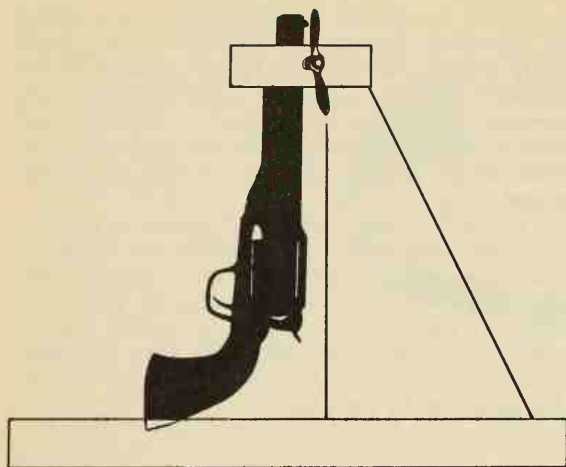
Rifle Loading Rack

Such a loading clamp is shown in the drawings. It can be permanently installed on your portable bench or clamped to permanent ones found at some ranges. Either way, make it the same from hardwood. Make the jaws to fit the barrel, and use an oversize wing nut to pull the jaws together. It's easy to turn out in a single evening, even with no more than a jackknife and hand drill. Pad the jaws with felt or leather, if you like. Top-notch guns are virtually irreplaceable, so don't take a chance on a fall ruining one of yours.

The caplock revolver, too, can be a lot easier to handle if provided with a **LOADING STAND**. The one shown is a basic design that can be adapted to almost any revolver or single-shot pistol with minor changes. Basically, it provides a socket for the gun butt, and a clamp for the barrel. Slip the gun in place, tighten the barrel clamp and the gun can't possibly get away from you nor does it matter much if you're interrupted during loading. The gun will stay right there until you finish and no powder will be spilled.

This loading stand can be screwed permanently to your own portable or private bench, but we prefer to fit it with a broad plywood base and use a heavy C-clamp to tie it firmly to whatever bench is being used. Properly built and fitted to the gun(s), it won't budge, even when ramming oversized balls or conical bullets.

PATCH CUTTERS are a big convenience for the round ball rifle. They are also quite simple to make. The easiest way to turn one out is to get a 3- or 4-inch



Pistol Stand

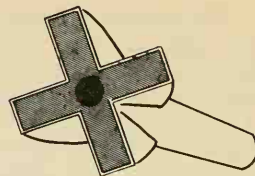
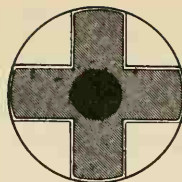
piece of pipe with an inside diameter same as the patch you want. File or grind one end from the outside only to produce a sharp edge. Finish by stoning or polishing and *keep it sharp*.



Patch Cutter

In use, simply place several layers of patch material over a piece of cardboard on the end grain of a 4 x 4 or similar timber set on a solid rest. Bring the cutter against the patch material, and then give it a good whack with a wood or plastic mallet. It will cut cleanly through. The material and the patches may be pushed out with a dowel or rod. Standard shotshell wadcutters work very well for cutting small round patches and are used in the same way.

Paper cross-patches are made with the same type of cutter, but there's no ready-made pipe for the job. You'll have to take a large-diameter piece of steel bar and laboriously saw, file, and drill to produce cutting edges of the proper size and shape. There's no short cut for this job, so have at it. Personally, I don't own one. I save the trouble by using simple 2- or 3-strip patches which are easily cut with knife and template.



Cross Patch Cutters

The dyed-in-the-wool muzzle-loading buff will eventually envision himself decked out in moccasins, fringed buckskins, and coonskin cap. And, if it makes him happy, there's no really valid reason he shouldn't have them. Of course, I don't recommend wearing them when going to the bank to apply for a loan, but otherwise . . .

Many black powder shooters do have full mount-man regalia, while others settle for a fringed hunting shirt and a battered wide-brimmed hat. Any seamstress can put one together for you, since it's a simple, basic tunic cut from soft buckskin. Periodically someone will offer in a magazine advertisement to make such garments to order. Frankly, I recommend getting your shirt that way instead of trying to make it yourself.

A fringed and beaded buckskin carrying case for your rifle will dress up the den a good bit. In basic form, nothing could be more simply made. Just fold over a length of skin into a long, slender envelope that will just accept the rifle. Sew across one end and up the side, leaving the case long enough that the rifle butt protrudes just a few inches.

Traditionally this type case was slipped over the rifle to protect it from moisture and dirt. It wasn't used in the manner of today's case or saddle scabbard. The cased rifle was carried in the hand, not slung over one's back or saddle.

The case furnishes lots of room to display your skill at beadwork and fringing. Boy Scout and similar manuals go into such decorative techniques in detail, so there's little reason for exploring them here.

We don't pretend this has been a complete list of muzzle-loading accessories — or that the instructions for their fabrication couldn't be more detailed. We could have written a full book on powder horns and flasks alone, but then there wouldn't be room for all the other things of even more interest.

Suffice it to say that accessories are essential to the enjoyment, if not the operation, of muzzle-loading arms. Give some of the foregoing suggestions a try and I think you'll agree.



Chapter 13

SO YOU WANT TO BUILD YOUR OWN

It might be said, I suppose, that there are roughly three types of black powder shooters wandering loose (sometimes much to the chagrin and embarrassment of wives and other close relatives) around the country. We've got the purist — the fellow who seeks only to shoot exactly the same equipment carried by his forefathers, and to copy their methods precisely. This fellow would rather not shoot at all than to use anything less than a genuine Hawken or other fine original piece; Curtis and Harvey "Diamond Grain" powder; genuine split buckskin patches; and everything else just exactly as it might have been found on the frontier. The individual who does this will certainly spend one hell of a lot of money for original pieces in fine shooting condition and, frankly, he will depreciate their value by shooting them. And, if the truth be known, his results on target may very well turn out to be less satisfactory than those obtained by the individual who is willing to take some advantage of present-day technology. This shooter may even go so far as to cast his bullets in the fireplace, read by candlelight, and demand that his wife chew buckskin and serve Indian pudding on feast days.

Then, we have the fellow who will spend hundreds and hundreds of dollars to make or have made the finest *modern* muzzle-loading arms that today's technology can produce. He cares not one whit what the resulting gun looks like and, in fact, it may resemble a piece of sewer pipe bolted to a railroad tie. But, its bore and other critical components will be produced to unbelievably fine tolerances from the finest materials that money can buy. This type of shooter is a "perfectionist," as opposed to the "purist" mentioned above. His interest is purely in accuracy and nothing whatever may be allowed to stand in the way of achieving the smallest group. He particularly delights in producing a modern muzzle loader that will exceed the highest degrees of performance ever obtained by original arms of the muzzle loading period. Buckskin and powder horn mean nothing to this fellow.

The purist and the perfectionist are more often than not monied professional men (and, of course, an

occasional feminine type) who can afford to take their preferred approaches to this grand game. Unfortunately, most of us do not fall into their income brackets. We make up the third class of front-loading shooters that must get the most shooting pleasure from every dollar we can scrounge out of the grocery money. I guess you might call us the "fun" shooters. We are neither purists nor perfectionists, nor do we get so deadly serious about the game that it starts giving us ulcers instead of curing them.

Handsome, accurate, and durable muzzle loaders can be had today for as little as \$50. It is a matter of record that Hopkins and Allen Under-striker Caplock Rifles manufactured by Numrich Arms and sold in this price range have repeatedly wiped the eyes of shooters using custom-made or original arms worth the price of a new Volkswagen. This doesn't mean that the Hopkins and Allen is the best gun available, but is stated simply to show that there are low-priced guns that will allow the black powder buff of moderate means to compete with the Cadillac drivers. Black powder buffs, like most other gun nuts, usually take pride in improvising and in being able to make what they can't or don't wish to buy. Consequently, you'll find many a Kentucky or Match Rifle proudly displayed as the handiwork of its owner-shooter. Some of these lads are machinists or toolmakers and they've made every cotton-pickin piece of that gun with their own two hands — just as did the frontier riflesmith of the 18th Century.

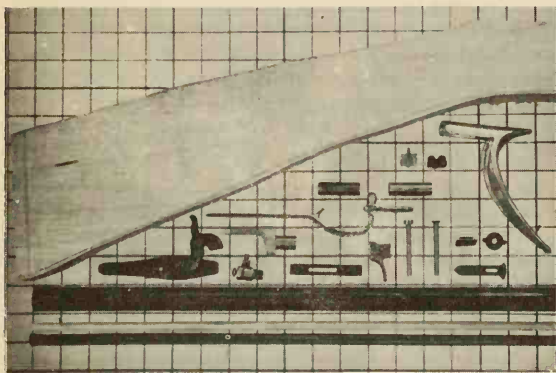
Producing a gun by this means demonstrates a remarkable degree of skill, patience, and perseverance that I, for one, do not possess. The average shooter simply does not have the time, skill or patience to sit down with files, chisels, drill, and hammer — nothing more, mind you — and carve the individual parts of a complete lock out of bar steel.

However, this doesn't mean that you or I cannot "make" a rifle (or pistol or shotgun, for that matter) from parts and materials that are readily available at reasonable prices. If you are reasonably handy with tools, and fairly well supplied with patience — not to

mention an understanding wife who will sit idly by while you ignore her for hours on end — you can put together in a single winter's long evenings, a brand, spanking new rifle with which to start the spring shooting season.

How? Well, you can buy a lock, finished or semi-finished, from one supplier; a rifled, but otherwise unfinished, barrel from another, a maple plank from somewhere else; and miscellaneous pins, screws, hardware, and sheet brass from the local hardware store. Then you can set about finishing each of these individual components and fitting them together into a complete gun. But, there's an easier way. And, frankly, I strongly recommend it for your first gunmaking project. In this day and age, we are besieged with kits from which we may make almost everything from a cock-eyed picture frame to a 36-foot cabin cruiser. The black powder buff hasn't been ignored. Various kits are available, containing all the essential components to produce a comely and accurate caplock or flintlock rifle.

Probably the major supplier of this type of kit is Dixie Gun Works, under the tutelage of one Turner Kirkland, a gentleman and a scholar who searches the world over to stock his warehouses with virtually every black powder shooting item one can imagine.



One of the many Dixie Gun Works kits available, this one, the "Plinker Rifle."

To illustrate the manner in which you may make your own "Kentucky" rifle, we've selected the Dixie Gun Works Kentucky Rifle Kit, patterned after the flintlock rifles produced by early 18th Century German gunsmiths in Pennsylvania. It is worth mentioning here that this kit may be had in either flintlock form, or the simpler percussion type of a century later. The two are identical except for the ignition system.

The Dixie Kentucky Kit arrives in a box somewhat longer than my redheaded secretary is tall. Opening it up, you'll find that it contains the following:

- Rifled octagonal barrel threaded for breech plug
- Semi-finished maple stock
- Complete lock
- Trigger and trigger plate
- Cast brass trigger guard
- Cast brass butt plate
- Ramrod and fittings and thimbles
- Sights
- Miscellaneous pins, screws, and small parts
- A complete set of illustrated instructions

Everything you need to finish, with hand tools only, into a complete Kentucky Rifle that is capable of shooting fully as well as those turned out by the frontier smiths of yore. Assuming, of course, that you do your job properly.

Where to begin? Simply examine all parts carefully and refer to your books and references until you are completely familiar with each and every part, its location and relationship with others, and its function in the completed arm. The one thing you cannot afford to do is to rush madly in with mallet and chisel and expect to complete the job in an evening or two. Even if you are an expert with tools, remember that this is an unfamiliar job, and you'd best take it easy if you want to be able to brag about the results.

First comes inletting the barrel into the stock. The stock is already roughly shaped to the proper external configuration and has a very slightly undersized groove machined to accept the octagonal barrel. Drop the barrel into the slot and push it as far to the rear as it will go without riding up out of the slot. At this point, you will begin to get an idea of the amount of wood that must be removed.

Back up a bit now, and take the rough breech plug and screw it fully home into the threaded end of the barrel. This is best done by clamping the barrel in padded vise jaws and fitting a smoothjawed adjustable wrench on the widest portion of the breech plug. If the plug appears to be too tight in the barrel, a bit of white lead applied to the threads will ease its passage. Screwed all the way in, the flat upper surface of the breech plug should be parallel with one of the barrel flats. While with a flintlock it doesn't really matter which flat, a more workmanlike job will result if it is the one bearing the trademark and caliber marking. If the plug does not draw up into proper alignment with a flat, very carefully file a minute amount of metal off either the barrel or the breech plug until proper alignment is achieved when the plug is turned in very tightly. Leave the plug in place.

However, if your project is percussion lock, the plug must draw up so that the bolster already installed on the barrel extends to the right horizontally and parallel to the top of the breech plug and tang.

At this point, take your files and true up the two sides of the plug and its tang. At the same time, shape

the rear of the tang to your liking, using the illustrations or pictures in your references as a guide. If at this point you taper the sides of the plug and tang very slightly inward toward the bottom, it will be easier to get a good fit in the stock.

Now, lay the barrel tang uppermost in the stock and slide it fully to the rear. Take a sharp pencil and mark around the tang. With a sharp-pointed knife, cut about $1/16$ inches deep just inside the pencil mark you have made. Using a narrow ($1/4$ ") chisel, remove the wood about $1/16$ " deep inside your incised line.

Before proceeding further, you'll have to have some means of knowing just where further wood must be removed to allow the metal to seat properly. So, emulate your forefathers by firing up a smokey candle and apply a thin coat of soot on the bottom and sides of the tang and as much of the barrel as does not enter the channel snugly. Place the barrel back in the wood, and press it down firmly so that the soot leaves an impression on the wood at all contact points.

Lift out the barrel and begin slowly and carefully peeling off very thin shavings of wood wherever soot

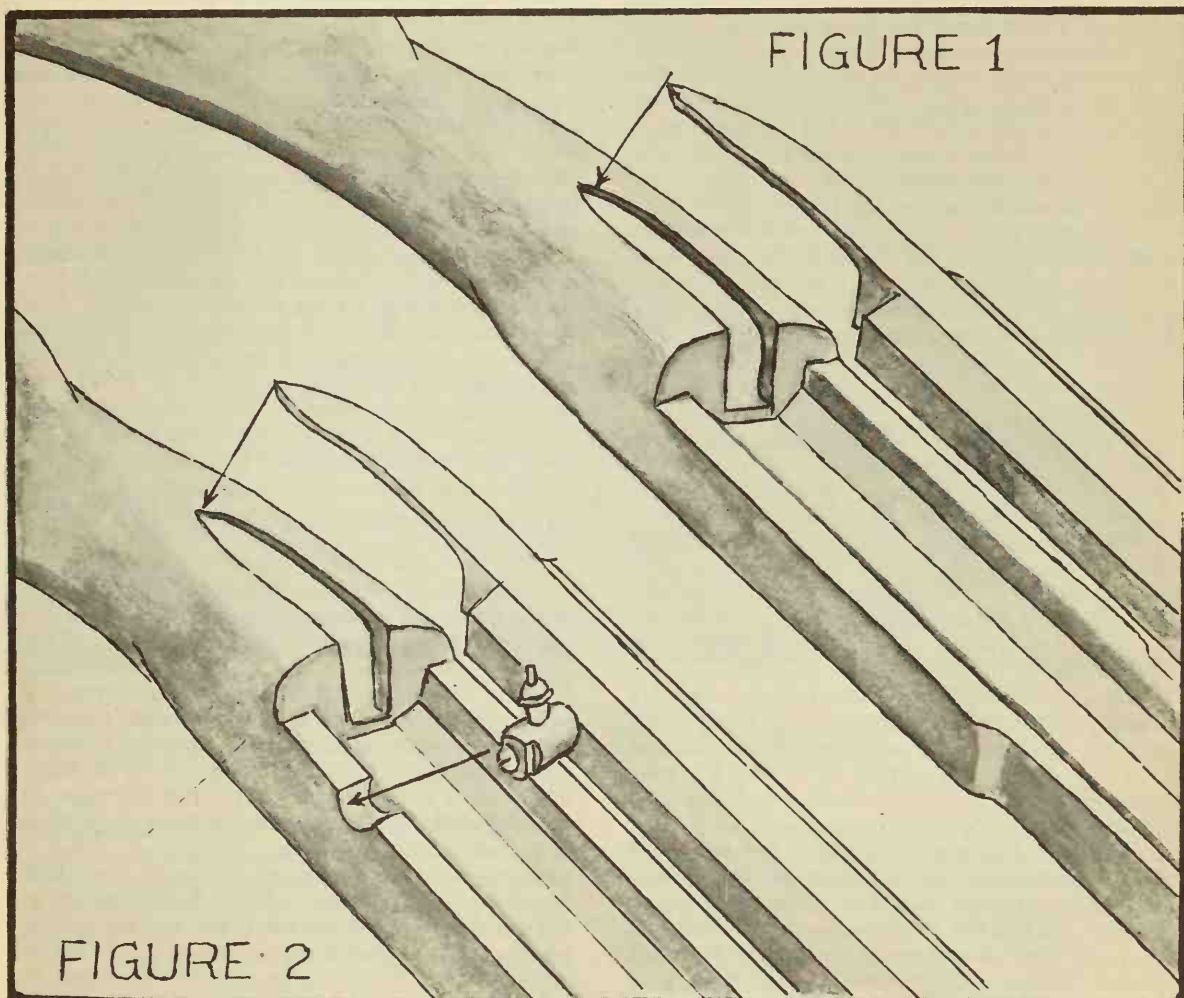


Photo courtesy of Dixie Gun Works

Tang must be carefully inletted into stock as barrel is inletted at breech. As barrel enters stock deeper, the bolster (drum) must also be inletted simultaneously or it will bear on the right side of the barrel channel and cause the barrel to tip, thus, spoiling the entire inletting job.

has clung. Right now, you can ruin the whole thing by getting in a hurry. Keep your chisels razor sharp and remove only the thinnest possible shavings. It's a lot easier to cut out more wood than it is to put back some you didn't mean to take out. Scrapers filed or ground to shape from old saw blades work very nicely for this. After the barrel has been in and out of the stock a few times, you will see that the metal is sinking perceptibly deeper into the wood. A word of caution — as the inletting proceeds, the sides of the recesses will remain black, even though the metal fits in easily. *Do not* tear away additional wood here. Wood-to-metal fit at the sides of the tang and barrel should be as snug that you can possibly keep them. Remove wood only from the bottom of the recesses. Under no circumstances, attempt to pry wood out by levering the chisel against the edges of the recess. This will certainly spoil the much-desired close fit. Continue this process until sufficient wood has been removed under the tang and rear of the barrel to allow the entire length of the bottom flat of the barrel to lie smoothly against the pre-cut channel.

As inletting progresses, you will encounter no difficulty with the flintlock gun. However, if you are using the percussion version, the bolster will eventually contact the wood. When it does, you will have to begin smoking it and inletting for it right along with the rest. If this is overlooked, the bolster bearing against the wood will throw the barrel out of alignment and louse up your entire inletting job.

The reinforced portion of the breech plug should make full, firm contact with the wood. If you've been sloppy and it doesn't, fill in with bedding compound as outlined in the chapter dealing with repairs.

When the barrel and tang appear to be inletted uniformly to one-half the barrel diameter, very carefully smooth up all inletting cuts and remove all soot from both wood and metal. Scrapers work best for this. Sandpaper will tend to spoil the clean, sharp wood to metal contact you've worked for so hard.

You may discover that the tang is seated only very shallowly into the wood at its rear end. If this is the case, then very carefully bend the rear of the tang down and deepen the inletting to match. The tang should be at least 1/16" deep in the wood, and 1/8" is much better.

Even after this is accomplished, a fair amount of tang will protrude above both wood and barrel. With files or grinder remove the bulk of this surplus, keeping the top of the tang flat and parallel with the top barrel flat, at the same time curving it gradually to match the curve of the stock. Leave about 1/64" of tang metal for later careful finishing flush with the wood of the stock.

Now, we need something to tie stock and barrel together while the lock and trigger are fitted which *must be done* before the tang screw (which is the most important fastening) can be fitted. Tenons (in the case

of the Dixie Kit, three) must be fitted to the bottom flat of the barrel. These tenons are rough castings which must be trued up with files, being careful to insure that their flat bases form straight male dovetails. Measure back 3 inches, 16 inches, and 30 inches respectively from the muzzle and mark the bottom barrel flat. Using a scratch-awl, mark around each tenon at these positions, outlining a notch the width of the *smaller* end of the dovetail, as shown in the accompanying illustrations. Following the illustrations, make vertical cuts with a hacksaw inside the outlined notches. Remove the excess metal with files, hand grinder, or small cold chisel, and then clean up with files. Next, using a very small triangular file, undercut the edges of the notches so that the dovetail base of the tenon can be driven securely in place. This is slow and exasperating work, and I know of no shortcuts. It is simply "cut and try" until the tenons fit the notches. Smoke the tenon bases to show where metal must come off. Should you inadvertently cut a notch a bit too large, its edges may be peened to close it up slightly, or solder may be used to help hold the tenon in place.

Personally, I consider this to be one of the most difficult operations in assembling the rifle. If you want to cheat just a little bit, the tenon bases may be filed smooth and flat. Then carefully silver soldered to the bottom flat of the barrel. However, you will have to cut dovetails for the sights on top of the barrel, and without the practice gained in fitting the tenons, you will probably do a lousy job here. And, it will be out in the open where everyone can see it. In the long run, it is best to go ahead and dovetail the tenons in place, gaining practice so you can do a workman-like job in fitting the sights.

The sights can be fitted at this time or the job may be left for later. Take your pick. The upright portion of the rear sight should be 11 inches forward of the rear face of the barrel, and the forward edge of the front sight should be 1 inch back from the muzzle. Carefully file the dovetail bases of the sights true, just as you did with the tenon. Mark the sight locations and very carefully saw and file the dovetails to shape. Take particular care to keep the bottom of the dovetails parallel with the barrel flat. Drive the sights in place, then file off the protruding portions of the bases to provide a neat appearance.

Now, to tie the barrel into the stock — carefully locate the tenon positions in the bottom of the barrel channel. Using a very narrow chisel, perhaps in conjunction with a small-diameter drill, inlet the tenons snugly into the bottom of the channel. They must be inletted deeply enough that the barrel can rest solidly on the bottom of its channel.

Mark the approximate center of each tenon, and, by measuring from muzzle and top flat of barrel, locate drilling point as shown. Mark them clearly on the outside of the stock. Seat the barrel in the stock, and

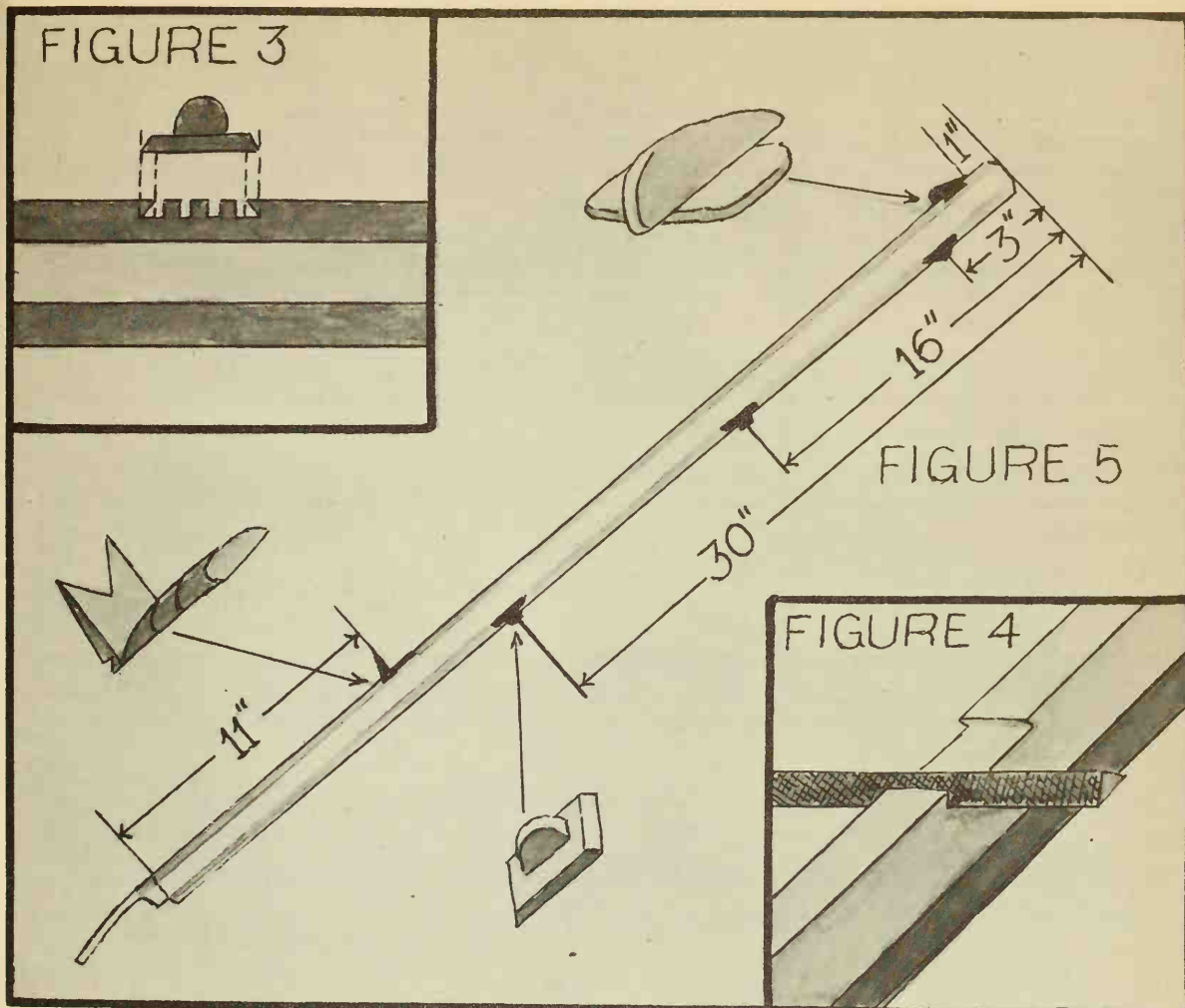


Photo courtesy of Dixie Gun Works

Dovetails for both tenons and front and rear sights must be carefully filed into barrel. Note locations measured from both muzzle and breech.

secure it tightly in place with C-clamps or with wrappings of reinforced tape or strong cord.

If you will be using a drill press, align and clamp the barrel and stock securely in place on its table so that the drill bit will pass squarely through stock and tenons. If the job is to be done by hand, then get someone else to stand off to the side and "eyeball" drill alignment as you proceed. In any event, first drill through with a 1/16" diameter bit. The hole *must* pass through the tenon, though it need not cut the exact center. Drill all three holes, and then pull the barrel out and check to make certain each did pass through the

tenon at an acceptable location. If you missed, you'll simply have to carefully plug the holes in the stock and start all over. Assuming the holes did pass through the tenons, take a 3/32" drill and open them up to finish size. Some slight correction can be made with the larger drill bit.

Barrel pins may be made from 6-penny finishing nails, or from brass wire or bronze or brass welding rod of the same diameter. Eventually, the pins will be filed flush with the surface of the stock, but it isn't necessary to do that now. Simply drive the pins in place, thus, securing the barrel solidly to the stock.

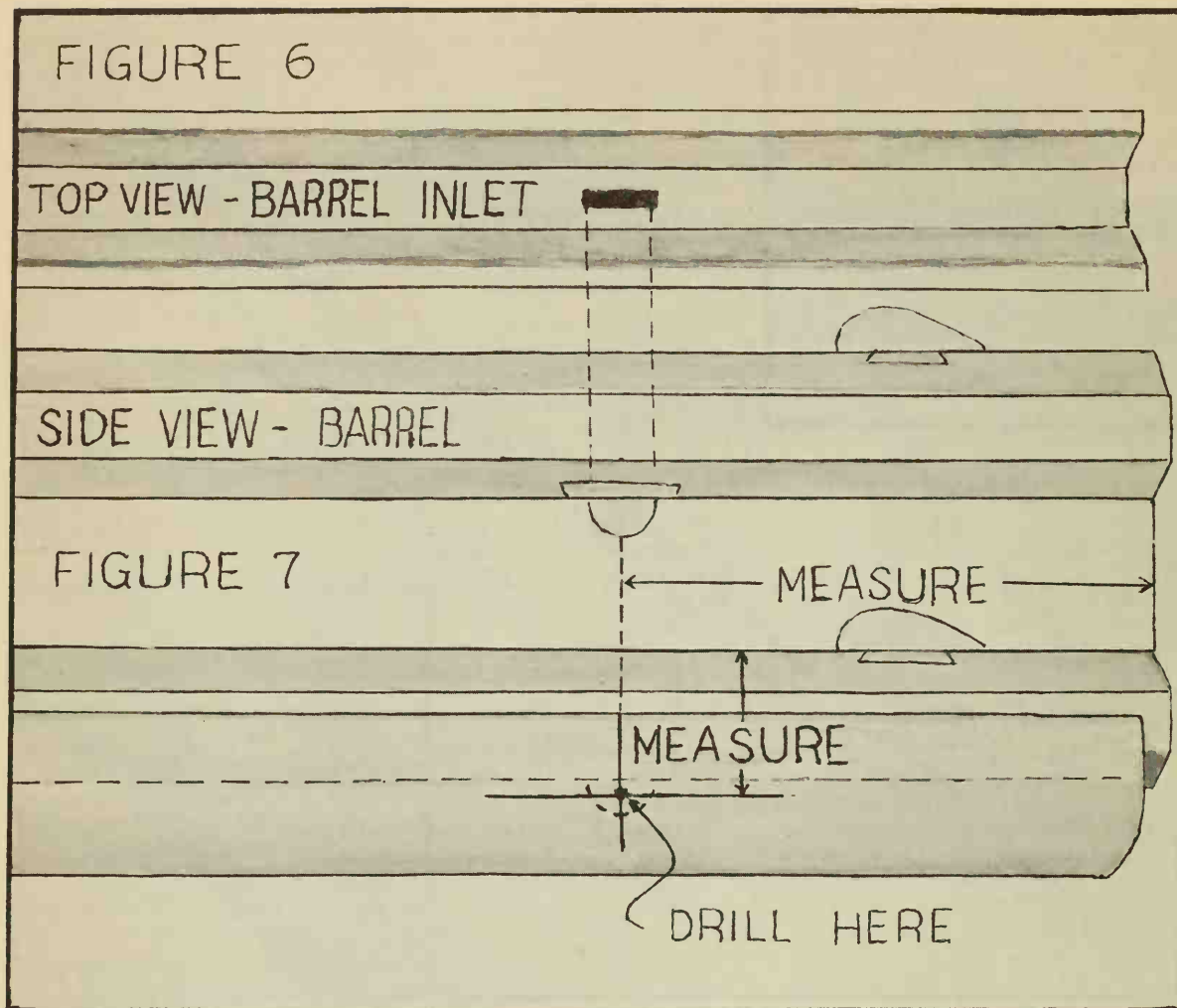


Photo courtesy of Dixie Gun Works

Tenons must be carefully inletted into bottom of barrel channel. Drilling of pin holes in stock and tenons simultaneously can be tricky and locations must be accurately measured and marked before drill is touched to wood.

Next comes the inletting of the lock. First of all, check the outside edge of the lock plate to be certain that it is smooth and even. If it is not, or if there are burrs upon it, clean up the entire perimeter with a smooth-cut file. A slight inward taper given the edges will facilitate inletting, but is not absolutely necessary.

The lock must be carefully aligned with the barrel. This really can't be accomplished properly unless you strip all internal parts from the lock plate. Do this carefully, and make certain you know which part goes back where, and in what order.

If the gun is to be a flintlock, use a cleaning rod

to measure the distance from the muzzle to the face of the breech plug. At this point, midway between upper and lower edges of the right vertical barrel flat, center-punch for the vent hole. Now, lay the lock plate, with flashpan attached, on the side of the stock, positioning it so that the punch mark lies just above the bottom center of the pan. Maintaining this reference, position the lockplate so that its lines flow smoothly with those of the stock. Looking at a few pictures of original flintlocks will give you a feel for this positioning. Outline the lock plate on the wood with a sharp pointed pencil or scribe.

FIGURE 8

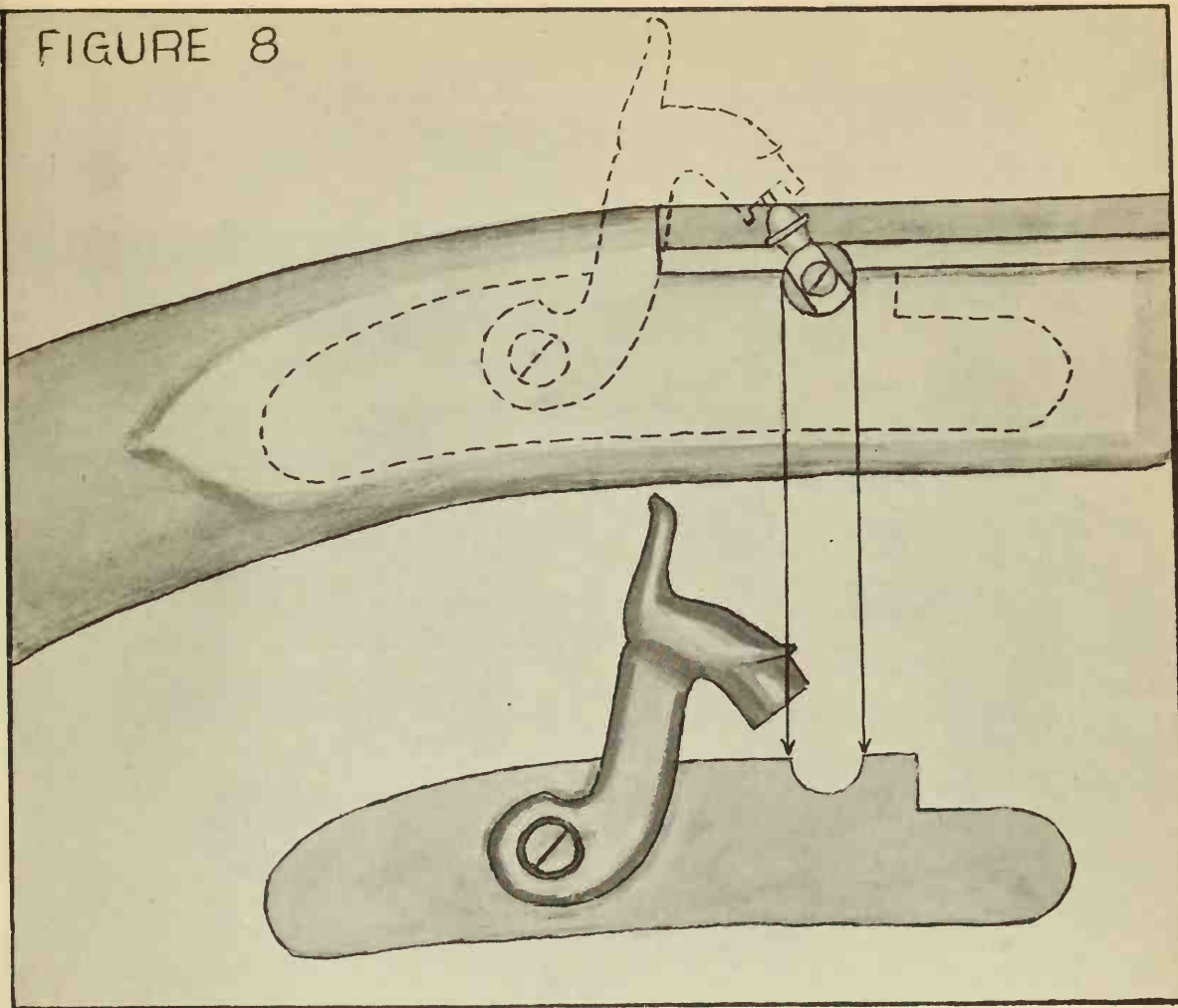


Photo courtesy of Dixie Gun Works

Lock must be accurately aligned with respect to drum and nipple.

Inlet for the lock plate just as you did for the breech plug tang and rear part of the barrel. Work carefully and slowly until the plate is seated at least one-half its thickness into the wood. At this point, assemble the internal parts to the lock plate and begin removing wood to allow them to seat in the stock as well. While a certain amount of clearance must be provided around the moving parts, removal of wood should be kept to the absolute minimum. Simply hogging out a huge hole (which is by far the easiest way of doing it) will seriously weaken the stock at a point not too strong at best. The lockwork recesses can be cut with nothing

more than knives and chisels, but various-sized drill bits, even a hand grinder with rotary files, will speed the work up considerably. When room has been made for all of the internal lock parts, continue deepening the recesses until the outer surface of the flash pan seats solidly against the barrel flat at the vent center-punch mark.

During this final inletting, care should be taken to insure that the outer surface of the lock plate is parallel, both vertically and horizontally with the right vertical flat of the barrel.

If you are working on a percussion gun, then lock

FIGURE 9

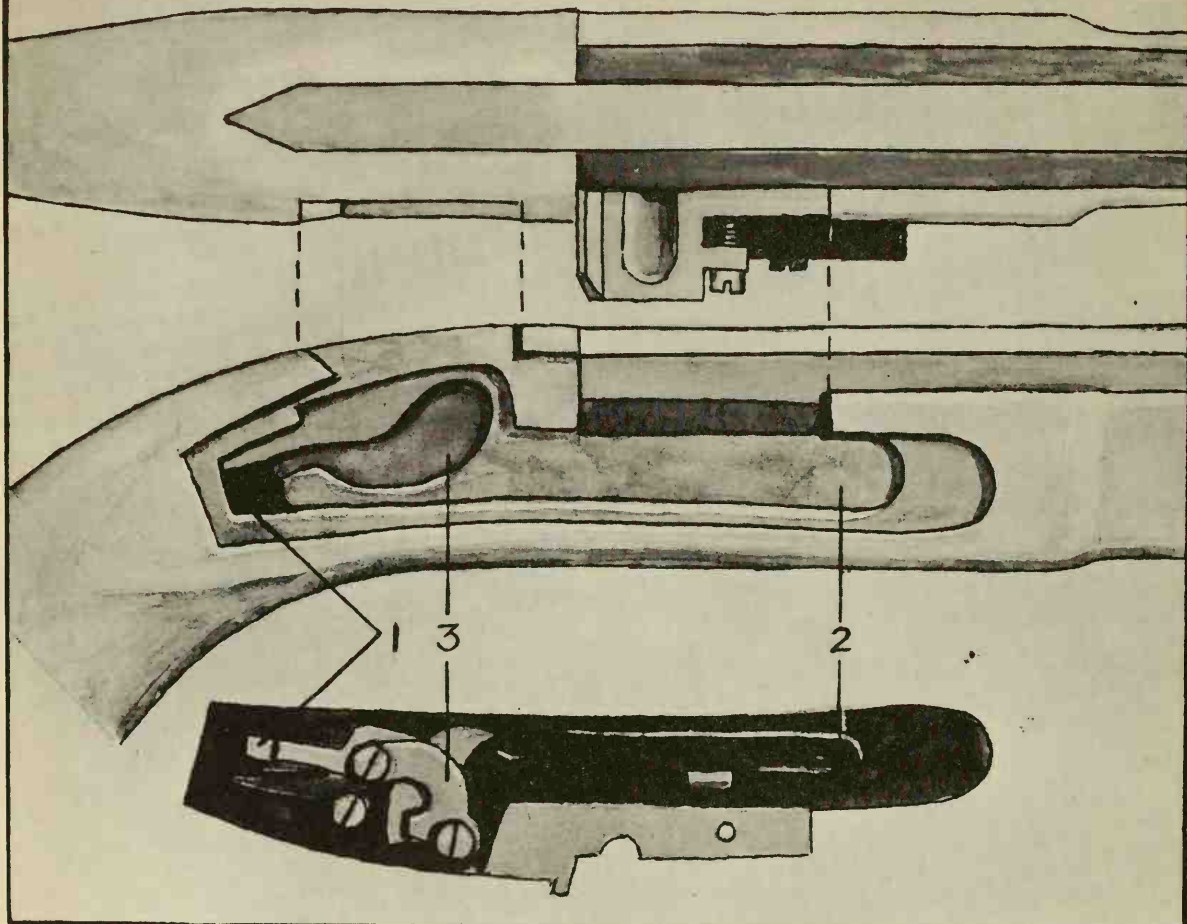


Photo courtesy of Dixie Gun Works

Inlet lockwork slowly and carefully. Remove only enough wood to allow the internal parts to work freely without binding.

alignment requires somewhat different treatment. Misfires, at best imperfect ignition, will result unless the hammer face strikes centrally and squarely upon the nipple. Strip the lock as before, but leave the hammer in place. Place the lock plate on the stock, and you will see that a half-round notch must be cut in the lock plate to clear the bolster. This is easily done with a round file or a hand grinder. As this notch is being cut, adjust its position so that the hammer face is aligned as shown with the nipple. Once correct alignment is obtained, then outline the lock plate and proceed with the inletting as outlined above.

The lock is to be held in place by a screw entering from the *left* side of the stock. If a drill press is available, drilling this screw hole properly is relatively easy. Remove the hammer and centerpunch the lock plate centrally in the reinforced portion between hammer and rear fence of flashpan. Level the lock plate on the drill press table, and drill through it squarely with a No. 21 drill. If no drill press is available, use a friend or two to eyeball the drill bit as squarely as possible.

Now replace the lock plate in the stock and either clamp or tape it solidly in place. Using the hole already drilled as a guide, drill through the stock with that same

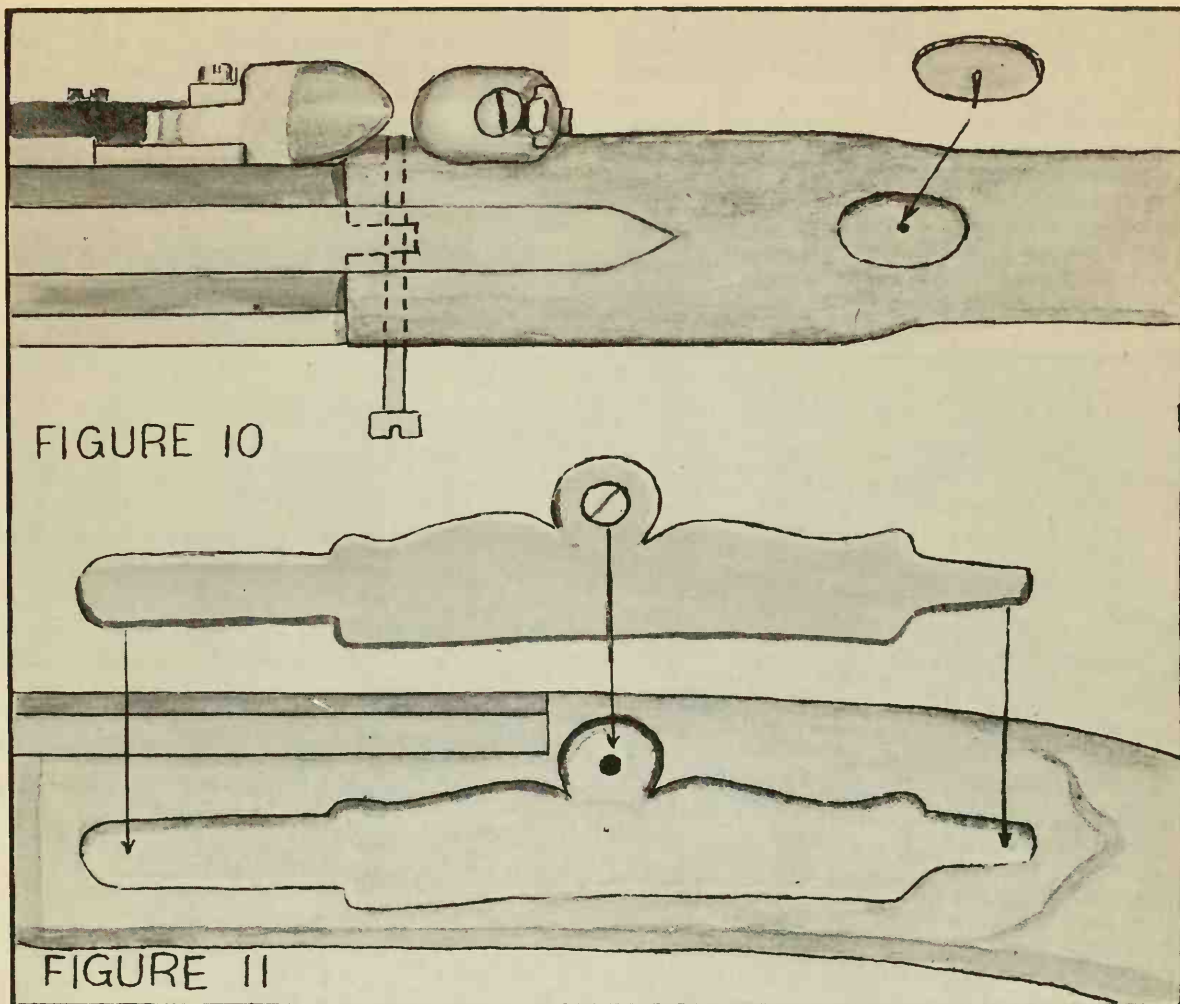


Photo courtesy of Dixie Gun Works

A single screw passing through side plate and stock secures the lock in place. Considerable care is necessary to make certain alignment is correct. If you goof, plug the hole in the stock with a hardwood dowel and start all over.

No. 21 drill. If the lock plate was inletted squarely into the stock, and if the hole was drilled squarely in the lock plate, this hole will emerge on the left side of the stock at the proper location. Take the brass side plate and place it on the left side of the stock so that the round boss on its upper edge is centered over the hole just drilled. If this places the plate in roughly the location shown, everything is all right. If not, the hole should be plugged and re-drilled at the proper angle. Centerpunch the boss on the side plate and drill through it with the No. 21 drill.

Now, take your files and very carefully clean up

the edges of the side plate. If you feel like exercising your individuality by reshaping the outline of the plate somewhat, please feel free to do so. Pass that same No. 21 drill through the lock plate, stock, and side plate next for a last check to make certain the hole is properly located and the side plate falls where it should. Remove both plates, and open up the hole in the stock with a No. 9 drill. Open up the hole in the side plate to the same diameter. If slight shifting of the side plate is necessary, it can be accomplished at this point by shifting hole location by filing it to the larger size.

Beg, borrow, steal, or — as a last resort — buy a

standard 10-32 tap and die set. Tap the hole in the lock plate full depth. Thread the end of the bolt blank with the 10-32 die. Make the threaded portion about 3/4" long.

Replace the lock plate in the stock, and pass the threaded bolt through the side plate and the stock. Turn it into the lock plate sufficiently to draw the side plate up snug against the stock. Adjust the position of the side plate on the stock, and then carefully outline and inlet it as you did the lock plate. Use the lock screw to draw the plate in as inletting progresses.

Since the brass is fairly soft, care must be exercised

to insure that the ends of the side plate do not bend outward instead of seating evenly in the stock. The side plate may be inletted its full depth and filed flush with the wood of the stock, or it may be inletted only about one-half its thickness and the edges filed to a pleasing bevel.

When the side plate has been fully inletted, cut off the excess of the bolt where it protrudes from the lock plate.

Now that the lock is fully inletted and secured solidly in place, recheck alignment of the vent hole punchmark with the flashpan. If any corrections are

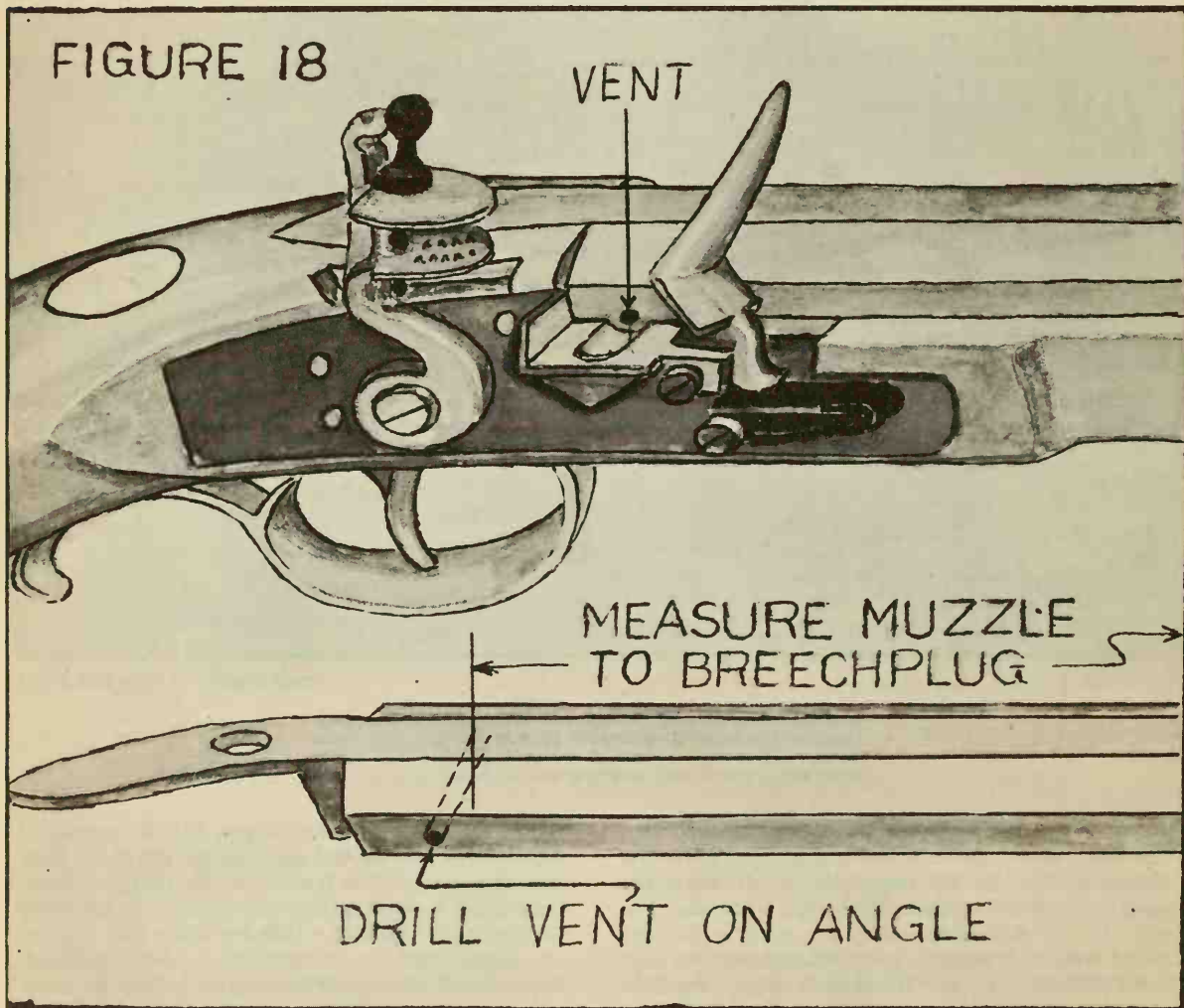


Photo courtesy of Dixie Gun Works

Flintlock vent hole is best drilled after lock has been completely inletted. Hole must enter bore with its full diameter just ahead of breech plug face, or ignition will suffer.

necessary, repunch properly. Drill into the barrel at the punchmark with a $3/32"$ bit. The hole should run parallel to the top and bottom barrel flats, but drift slightly forward at its inner end so that the full diameter of the hole is just barely forward of the breech plug face.

The trigger and tang screw are installed next. Draw a center line on the underside of the stock extending from the rear of the ramrod groove well past the rear of the lockplate. Centered on this line and beginning about $1/4"$ behind the position of the hammer screw, cut a vertical slot into the stock sufficiently wide to

accept the flat upper portion of the trigger. Cut this slot deep enough to intersect the sear recess cut earlier from the right side. Positioning the trigger in this slot so that it will engage the sear approximately $1/8 - 3/16"$ from its rear edge, mark the outline of the trigger plate and continue inletting until the plate is almost flush with the wood. As the inletting progresses, take extra care to insure that the trigger remains vertical. As further inletting transpires, the lock will have to be removed because the sear will otherwise block progress of the trigger.

When the trigger plate is about $1/64"$ from being

FIGURE 12

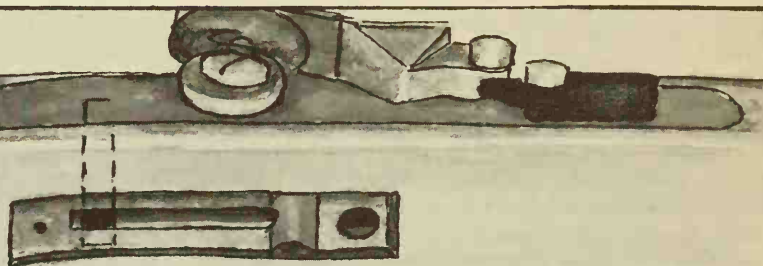


FIGURE 13

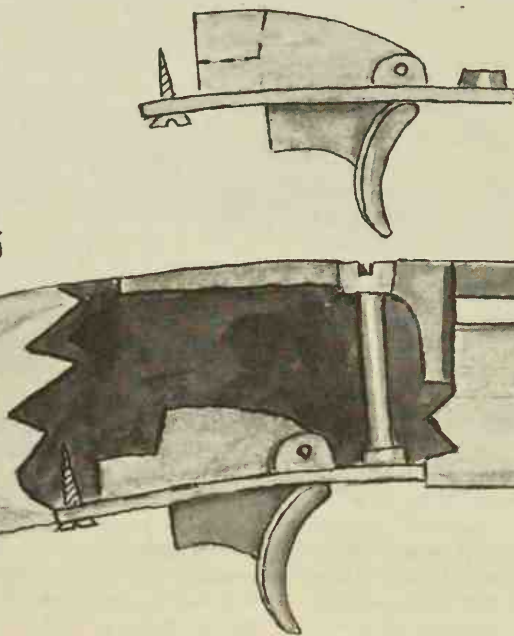


Photo courtesy of Dixie Gun Works

Trigger plate must be kept vertical as it is inletted and tang screw must line up with forward end of trigger plate.

flush with the wood, stop the inletting and file down the rear portion of the trigger as shown so that with the hammer cocked and the trigger plate fully seated, the trigger will just barely contact the sear. At this point, drill and countersink a hole in the rear of the trigger plate to accept a wood screw. Drill a pilot hole in the stock for this screw and turn it in solidly to hold the trigger plate in place.

Centerpunch the upper surface of the tang approximately $3/4$ " behind the rear face of the barrel. Using eagle-eyed friends or drill press, carefully run a No. 21 drill through the tang, stock, and the reinforced forward portion of the trigger plate. Drill alignment is quite important here, for the trigger plate presents a rather small target. It is best to withdraw the drill as soon as you feel it touch the trigger plate. Then remove the plate and determine if the drill struck properly. If not, plug the hole in the stock and start over. If you go ahead and drill completely through the trigger plate and the hole is too far out of place, the plate must either be replaced or welded up. Once the hole is properly located through all three parts, tap the trigger plate for a 10-32 thread and thread the end of the blank tang screw the same for about $3/4$ ". Open up the hole in the tang and stock with a No. 9 drill, insert the tang screw, and turn it into the trigger plate securely. Assemble the lock to the stock, and make certain that the trigger will drop the hammer, yet is not bearing too heavily upon the sear. If all checks out properly, countersink the hole in the tang so that the head of the tang screw will be flush with its upper surface. Cut off the excess tang screw protruding from the trigger plate.

File the edges that are to be inletted into the stock of the brass trigger guard smooth and even. Also file the tenons of the trigger guard flat and straight. Position it over the trigger and trigger plate as shown, and then carefully mark around the tang portions to be inletted. Using the procedures already described, inlet both tenons and guard until tangs are very nearly flush with the surface of the wood. With the guard clamped or taped securely in place, drill through the stock and tenons as was done on the barrel and pin the guard in place.

At this stage of the game, you have a gun that will shoot! There is still one hell of a lot of work to be done to make it look and feel like a Kentucky should. But, you have performed all of the operations necessary to convert that basket full of rough hardware into a shootable firearm. If you're like most do-it-yourself fans, you will not be able to resist dashing off to the range with powder horn and bullet pouch to see if everything works before putting in those many, many additional hours required to give the gun the polish and finish it now needs.

Actually, I can think of no single reason why you shouldn't shoot the gun at this stage; and, in fact, feel

it would be pretty hard to resist the temptation to do so. Keep in mind, though, that the raw, unprotected wood can easily be damaged (particularly at the toe of the stock) or badly stained by oil, grease, or powder fouling. To avoid trouble in these areas, it is probably safer *not* to shoot the gun until it has been completely finished. Let your conscience be your guide.

The Dixie Kit stock is cut squarely across the butt, and is not semi-inletted for the brass butt plate casting. Considerable wood must be removed, and the butt plate itself requires a lot of filing to shape.

The latter first. Carefully true up the plate where it will contact the wood. Keep all edges clean and square, and both sides as identical as possible. While doing this, file or grind off the large casting "gate" on the side. This is simply superfluous metal formed there during the casting process.

With the face of the butt plate trued up, lay it in position on the butt of the stock and mark on the wood its position there. Keep in mind that when installed and finished, the top line of the butt plate must be a smooth, clean continuation of the top line of the stock comb. With coping saw, band saw, or what have you, hog off the bulk of the excess wood outside the marked position of the butt plate. Make the cuts perpendicular to the center line of the stock.

Get out your candle and your sharpest chisels again. Smoke the freshly filed surfaces of the butt plate, and begin spotting and inletting it just as you did the tang and breech plug. Probably the simplest method is to work the butt plate down and forward simultaneously until it is properly seated. Chisels must be kept *very* sharp as most of the cutting here is directly across the grain. While the wood may be cut straight across, a far more secure fit of the butt plate is obtained if wood is left to fill the hollows in the plate. As inletting progresses, tapping the plate with a rubber or rawhide mallet will produce better soot impressions. Throughout the operation, keep the wood in as intimate contact with the metal of the plate as possible. There is always the temptation to simply maintain firm, clean contact at the outer edge, hogging out the rest of the wood. If this is done, then large gaps will show up when wood and metal are dressed down to their final shape.

Once the butt plate is fully inletted, clamp it securely in place and centerpunch a hole location one-half inch back from the front end of the top strap. Drill through the brass and at least an inch into the wood with a $3/32$ " drill. Obtain a solid brass countersink wood screw, preferably about 1-1/2 x 9 size. Open up the hole in the brass to accept the shank of the screw and countersink to accept the screwhead flush with the surface of the plate. If run slowly, a standard combination "screw drill" may be used to do the entire job in one operation — pilot hole in wood, clearance hole in plate, and countersink. Turn the brass screw in tightly. If difficulty is encountered in

FIGURE 14

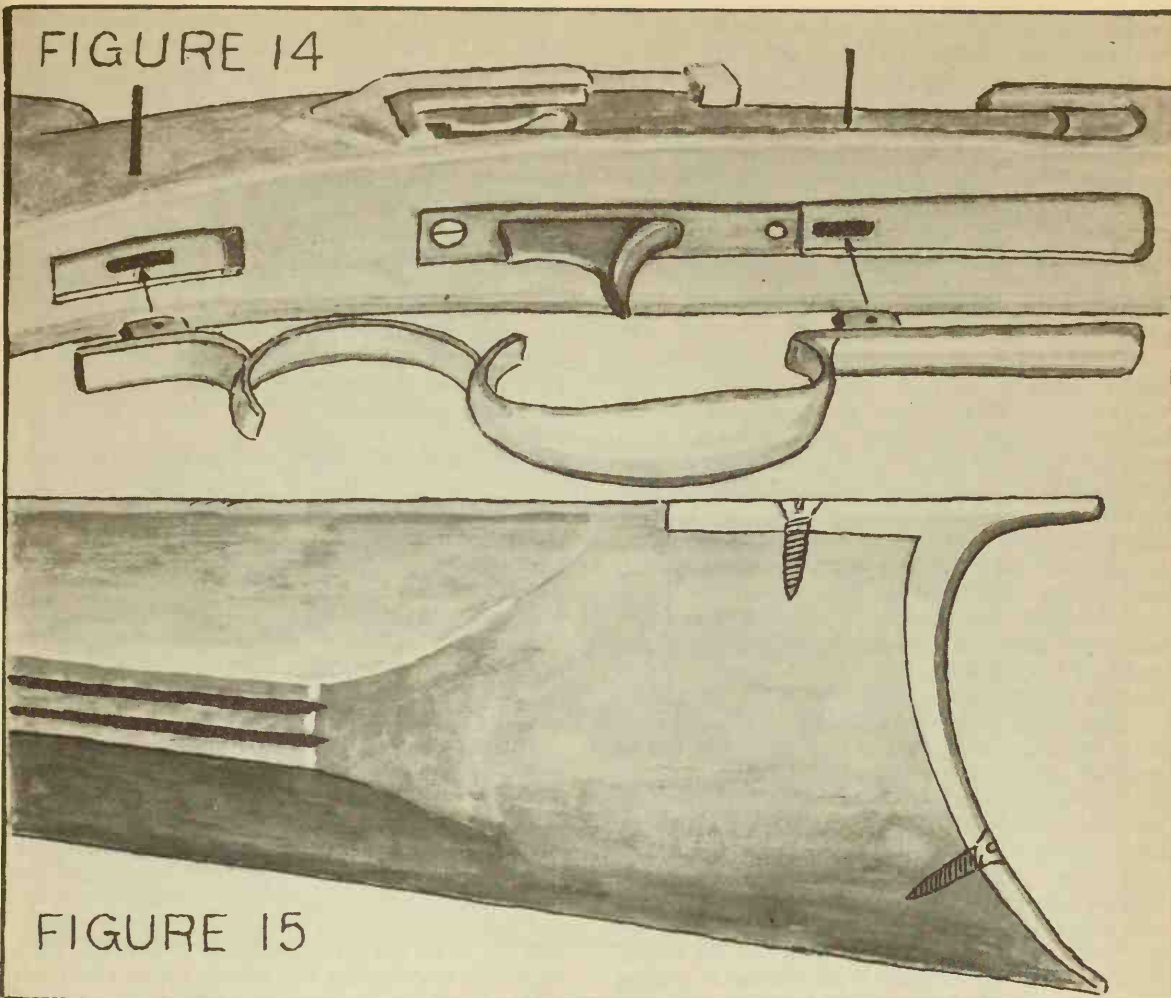


FIGURE 15

Photo courtesy of Dixie Gun Works

Trigger guard is simply inletted, but care must be taken to insure that it is vertical when the job is finished. Butt plate must be drawn down tight so that there is no gap around its perimeter.

turning it into the hard maple of the stock, apply a little soap to the threads or open the pilot hole slightly.

Centerpunch another screw hole slightly below center of the butt plate arch. Drill and countersink here for a much larger, solid brass screw and turn it into place. With both screws turned in tightly, check wood-to-metal fit. If any gaps have developed, remove the plate and carefully trim the inletting until a perfect fit is obtained. After this is done, if you really want a first-class job, "regulate" the screws so that the slots in their heads run vertically. This can be done by very carefully deepening the countersink holes until

the slots will come vertical as the screw is turned in tightly.

Get your files out again, and carefully dress the excess brass down flush with the wood. Be very careful not to taper the brass backward but, rather, make it a straight continuation of the stock lines. It may be that at some points wood will overhang brass, but ignore this for the moment.

Using pictures of original guns as a guide, use files and fine-cut wood rasp to bring the stock and butt-plate to the desired cross section. Having accomplished this, use files and coarse abrasive cloth wrapped

around shaped pieces of hardwood to clean all casting marks from the rear face of the butt plate. Use care to insure that the flat edges of the plate are identical on both sides. Don't carry the arch deeper on one side than the other. This shaping operation is carried directly across the screwheads, dressing them flush with the surface of the plate. Try to produce a smooth, even surface free of waves and humps or hollows. Graceful curves are a characteristic of the Kentucky Rifle, and you don't want to louse them up at this stage of the game. Final polishing to a mirror-bright surface is best saved until later when the last finishing touches are being applied.

Careful trimming and shaping of the already-inletted trigger guard is next in order. Using small flat and half-round files, remove all mould parting lines inside and outside the guard. Then, clean all mold roughness off the inside. A more attractive appearance will result if the cleaned surfaces are slightly rounded, not left flat. Take your skinniest three-cornered files and work carefully into all the notches and joint areas to produce clean, bright brass surfaces. With a fine-cut file, carefully shape the outer edges of the guard. Some trouble can be saved here if a template is made to insure that both sides of the guard will be shaped exactly. Keep the filed edges vertical. Again, use pictures or original guns to guide you.

Now, begin filing across the outer surfaces of the guard to remove all mould and casting marks and to arch the surface. Leave the guard as thick as practicable while producing a clean, bright surface. Be particularly careful that the smooth flowing curves are not distorted by this filing. Maintaining the arched cross section, thin out the outer edges of the guard, bringing them to a small radius, not a *sharp* edge. Along with this dressing of the guard, file down the front and rear tangs (the inletted portions) flush with the surface of the wood. If any difficulty is encountered in keeping the tangs seated solidly in the wood, install small, solid brass wood screws and give them the same treatment as those used to secure the buttplate.

This is as good a time as any to fit and finish the ramrod. The Dixie Kit stock has a pre-drilled ramrod channel. The rod blank is slightly oversized for the rear portion of the channel. Lightly sand the entire rod, applying a little extra effort on the end that is to fit into the hole at the rear of the channel. The inside of this hole may also be smoothed considerably by wrapping steel wool around a brass bore brush of the proper diameter and working it in and out of the hole vigorously on the end of a conventional cleaning rod. Having smoothed the rod well, carefully sand the channel full length so that the rod fits freely. A neater job can be done if fine-grit paper is wrapped around a smaller dowel and worked back and forth in the channel. This will avoid rounding the channel edges, as is sure to occur with hand sanding.

Three ramrod pipes are furnished formed from sheet brass. The two identical ones fit in the open groove with their front ends four inches and fourteen inches respectively from the tip of the stock. The third one, with its extension piece, fits at the point where the groove becomes a hole. Carefully inlet the first two thimbles until they are seated so that their bores form a continuation of the ramrod groove. The most workmanlike job results if the thimble flanges are soldered together and inletted to full wood-metal contact. However, the job can be simplified considerably by leaving the thimbles as is, and simply cutting V-section notches as shown. Regardless of the method used, when the thimble is inletted to the proper depth, drill a 3/32" diameter hole through stock and thimble flange and drive in a pin identical to those used to secure the barrel.

The rear thimble presents a somewhat different inletting exercise. Its forward portion must first be inletted part way just as the others. As this inletting progresses, the thimble extension must be carefully bent and shaped to the same contour as the bulge of the stock. Once this is accomplished, then inletting is continued until the thimble bore is properly aligned with the ramrod, and the extension is inletted its full depth into the wood. If the extension is reluctant to stay down in its recess, secure with a small brass screw and file the head flush.

At this point, try the ramrod blank in the thimbles to make certain that it may be easily pressed in place and withdrawn, yet is not so loose that it will slide out of its own weight when the muzzle of the completed gun is lowered. A threaded brass tip is supplied for the rod. Carefully file or carve a tenon on the tapered end of the rod to fit the recess in this tip. Secure a snug fit, and make certain that the tip is properly in line with the rod; we don't want it pointing off toward the south forty. The traditionalist will want to pin or crimp this tip in place, but a simpler and equally effective method of securing it to the rod is the use of a small amount of epoxy cement. A steel worm threaded to fit the tip is furnished and other accessory tips may be purchased. Taper the rod carefully down to tip diameter.

A brass shield-shaped name or initial plate is supplied with the Dixie Kit. This may be carefully inletted into the upper surface of the wrist of the stock, about an inch behind the tang. The traditionalist will solder a small brass pin to the underside of this plate, and drive it in place after inletting. But the epoxy just mentioned works quite well.

No nose cap is supplied with the kit, but one may be purchased from any of several sources and carefully inletted, as was the buttplate. Most do-it-yourself nose-caps are intended to be secured by a small brass screw turned in from inside the barrel channel. Carefully file the nose cap metal flush with the wood of the fore-end.

At this point, your Kentucky has everything on it

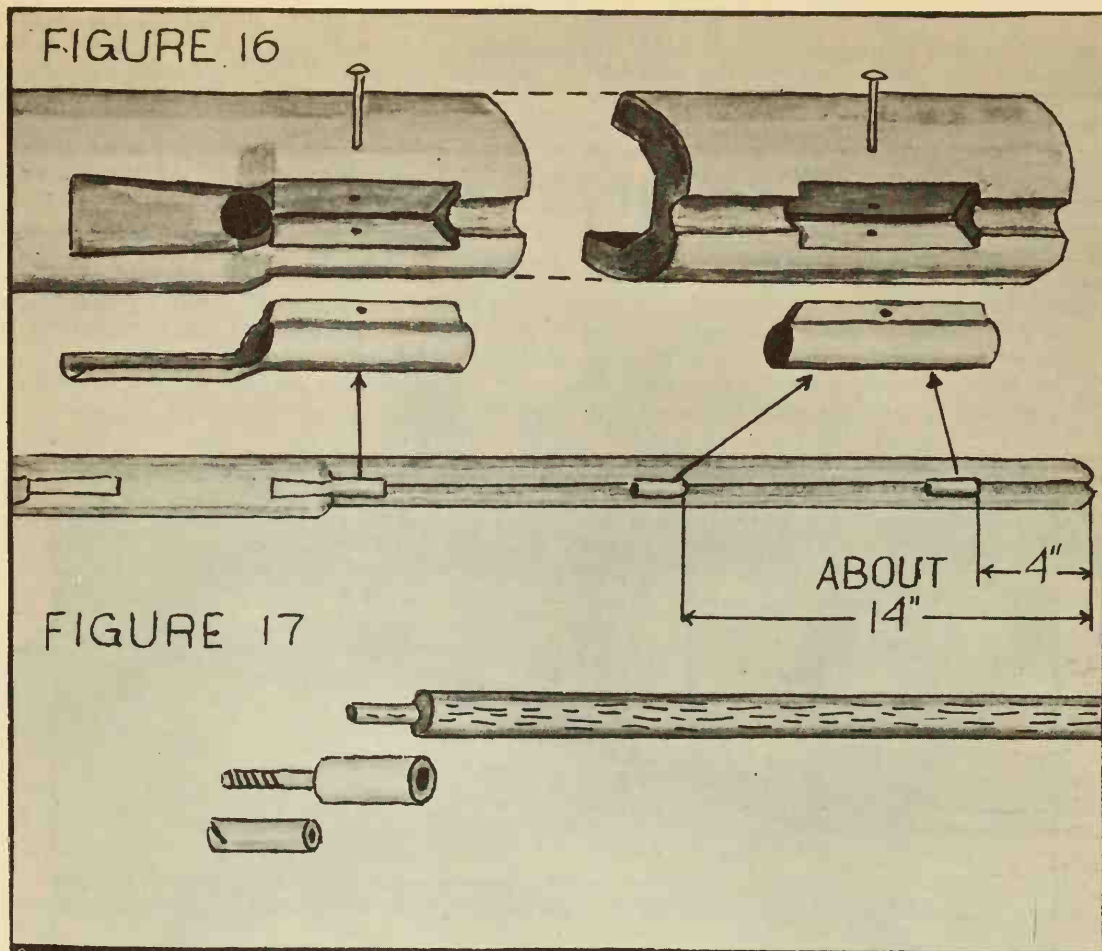


Photo courtesy of Dixie Gun Works

Fitting ramrod pipes is not a great task, but don't get in a hurry and hog out too much wood. The pipes must all be in line when the job is finished.

necessary to make it safe, curable, and reliable. All that remains to be done is careful sanding and final shaping of the stock, polishing of the metal parts and application of an external finish to both wood and metal. It may be, however, that you wish to apply decorative inlays and/or a patch box that will be both decorative and utilitarian. If such is the case, these items should be carefully formed and inletted before final shaping and sanding of the stock. It is worthy of mention, however, that most people feel a Kentucky Rifle is rather naked without at least some decoration of this type.

Bringing the stock to final shape requires very little effort in the case of the Dixie Kit. In fact, leaving the existing contours as they are and simply sanding the

stock carefully will produce a very nice looking job. Even so, some shaping will be required in the area of the lock plate, trigger guard, and blending the machining marks on the butt and fore-end to produce smooth, flowing curves. Kits containing less well-finished stocks or working from a rough blank is an entirely different matter.

The final polish to be applied to the butt plate and other brass parts is done in conjunction with finish sanding of the stock. Sandpaper should be backed with a solid block in order to prevent tapering or rounding off the edges of the brass. By sanding directly over wood and metal where they join, perfect matching of the two is obtained. Once the two have been sanded down with the finest grit paper you have, the exposed

areas of the brass should be polished in boot-black fashion with strips of very fine abrasive cloth, and finished up with worn emery cloth. For that final high shine, red jewelers' rouge on a soft cloth or loose buffing wheel is by far the best. Polishing areas inside the trigger guard is best done with very narrow strips of abrasive cloth and emery cloth or felt bobs in a hand grinder. Once the brass has been polished to the desired luster, the residue of all polishing material must be thoroughly washed off after which a coat of clear lacquer may be sprayed on to preserve the shine without frequent polishing.

In most kits, a fair number of burrs and machining marks will be found on the various parts of the lock. With small fine-cut files and abrasive stones, clean off all burrs and true up all edges. Make certain to keep

all of the curves smooth and flowing, and avoid enlarging any holes. It may be that you would prefer a bevelled lock plate. If this is the case, then you will have originally inletted the lock plate only to one-half its thickness. Then, at this point, very carefully file a smooth, uniform bevel that ends just at the surface of the wood. Give the trigger plate and trigger this same cleaning-up treatment with files and stones.

All that remains now is the application of an exterior finish to the metal parts of your Kentucky. The barrel can be blued by any one of several readily available home-use solutions. However, a proper "browning" job of the type originally used is much to be preferred. The procedures for this are covered in detail in the chapter devoted to finishing and refinishing of metal parts.

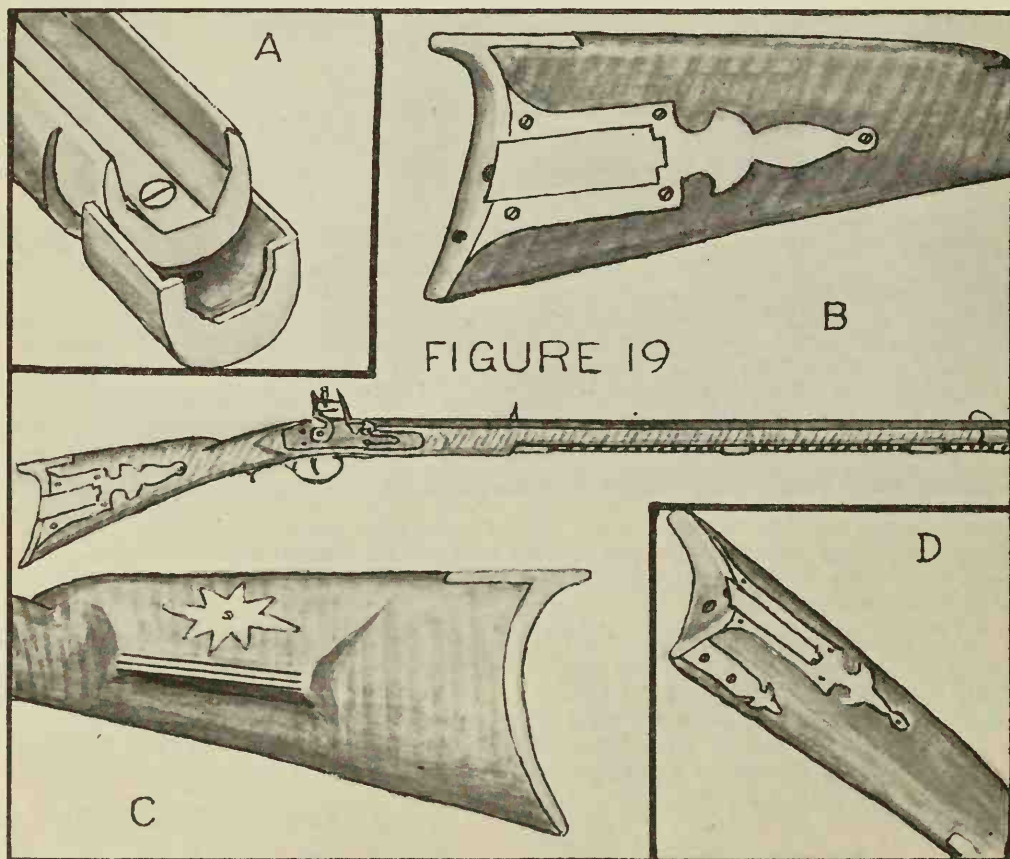


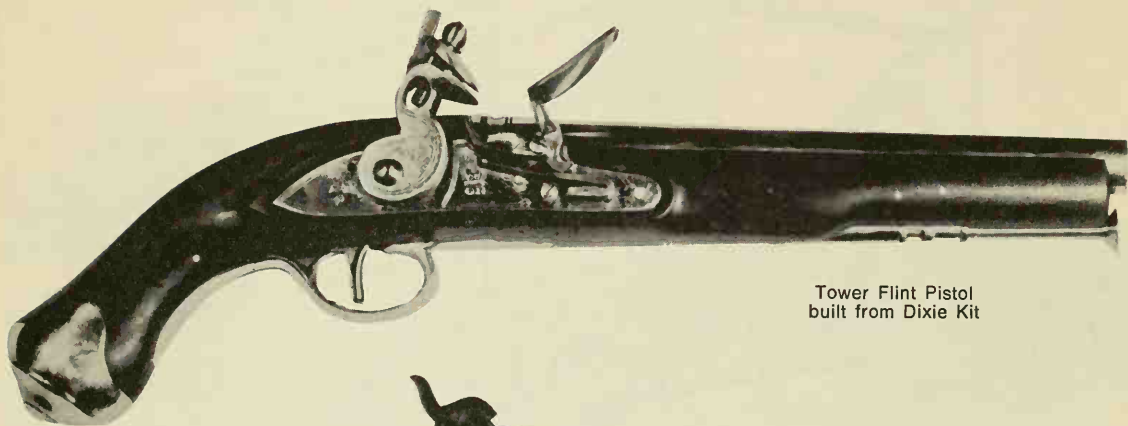
FIGURE 19

Photo courtesy of Dixie Gun Works

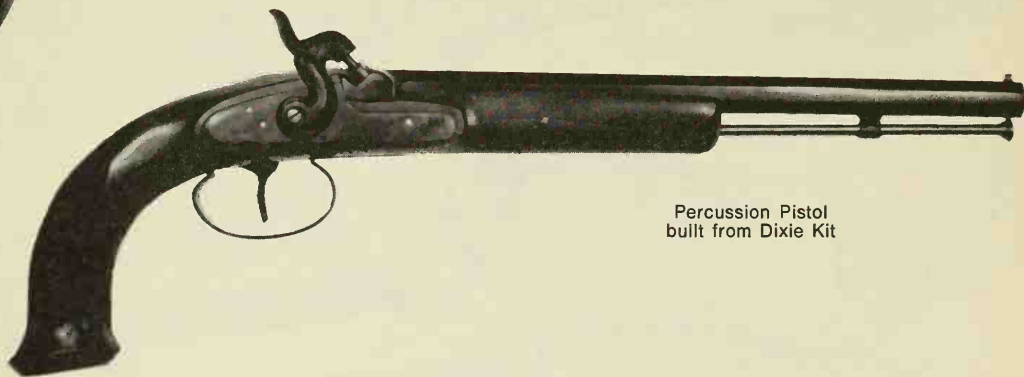
Most fore-end or nose caps are easily secured by a screw entering from the barrel channel — or they can be cemented in place with an epoxy compound. All manner of ornamentation may be inlaid in the stock if you so desire. Simply cut pieces to shape from sheet brass, inlet, and pin or epoxy in place.

Chapter 14

BUILD A CAPLOCK PISTOL



Tower Flint Pistol
built from Dixie Kit



Percussion Pistol
built from Dixie Kit

The caplock or flintlock pistol is virtually identical in every way to its rifle counterpart. It possesses all the same parts which are assembled in the same manner, and they perform the same functions. All of which is to say that if you hanker to build a single-shot muzzle-loading pistol, it may be done in exactly the same way already outlined for the rifle.

Assuming you'd like to do the job from a kit which contains all the necessary parts, rather than start from scratch, check the Dixie Gun Works' catalog. In it, you'll find a Kentucky-style .36 caliber pistol kit. It's offered in either percussion or flint persuasion and the two are identical otherwise.

The kit contains an octagon barrel with breech

plug and tang brazed in place (that of the rifle is threaded) and, in the percussion version, the bolster and nipple installed; fully assembled lock and side plate; trigger and trigger plate; brass trigger guard; rough-shaped maple stock; and miscellaneous pins, screws, ramrod, rod pipes, sights, barrel tenons, etc.

Assembly and fitting of the various parts and assemblies is conducted exactly as for the rifle, except that the breech plug is furnished permanently installed on the barrel — one less step for you to worry about. There just isn't any point in repeating the whole procedure here. The one advantage possessed by the pistol is that there is much less wood work to do, and fewer dovetails to be filed.

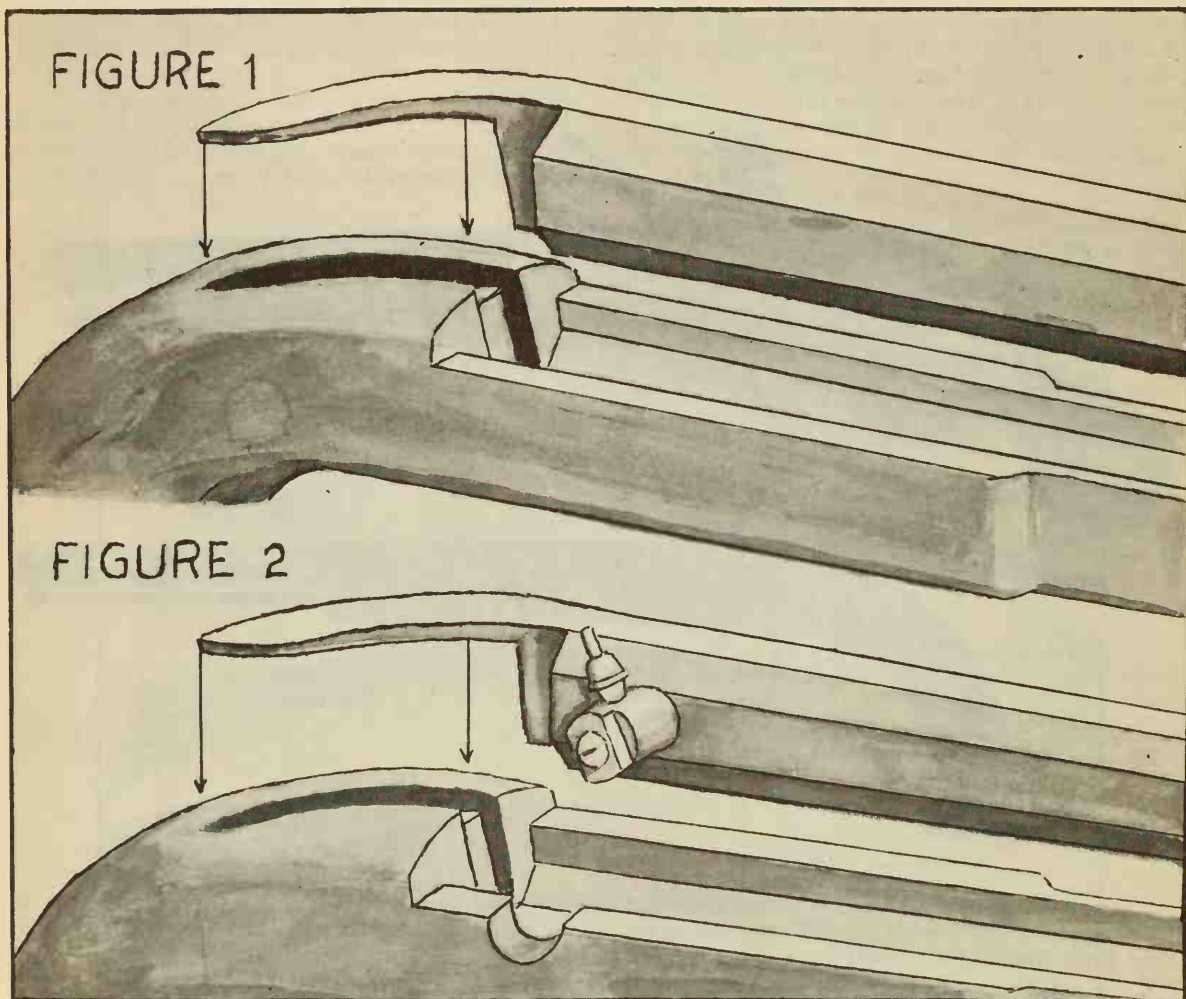


Photo courtesy of Dixie Gun Works

The pistol barrel comes with breech plug and drum already installed for the percussion version and is inletted into the stock in the same manner as a rifle. The flint version, at top above, requires that the vent hole be drilled after inletting of both barrel and lock.

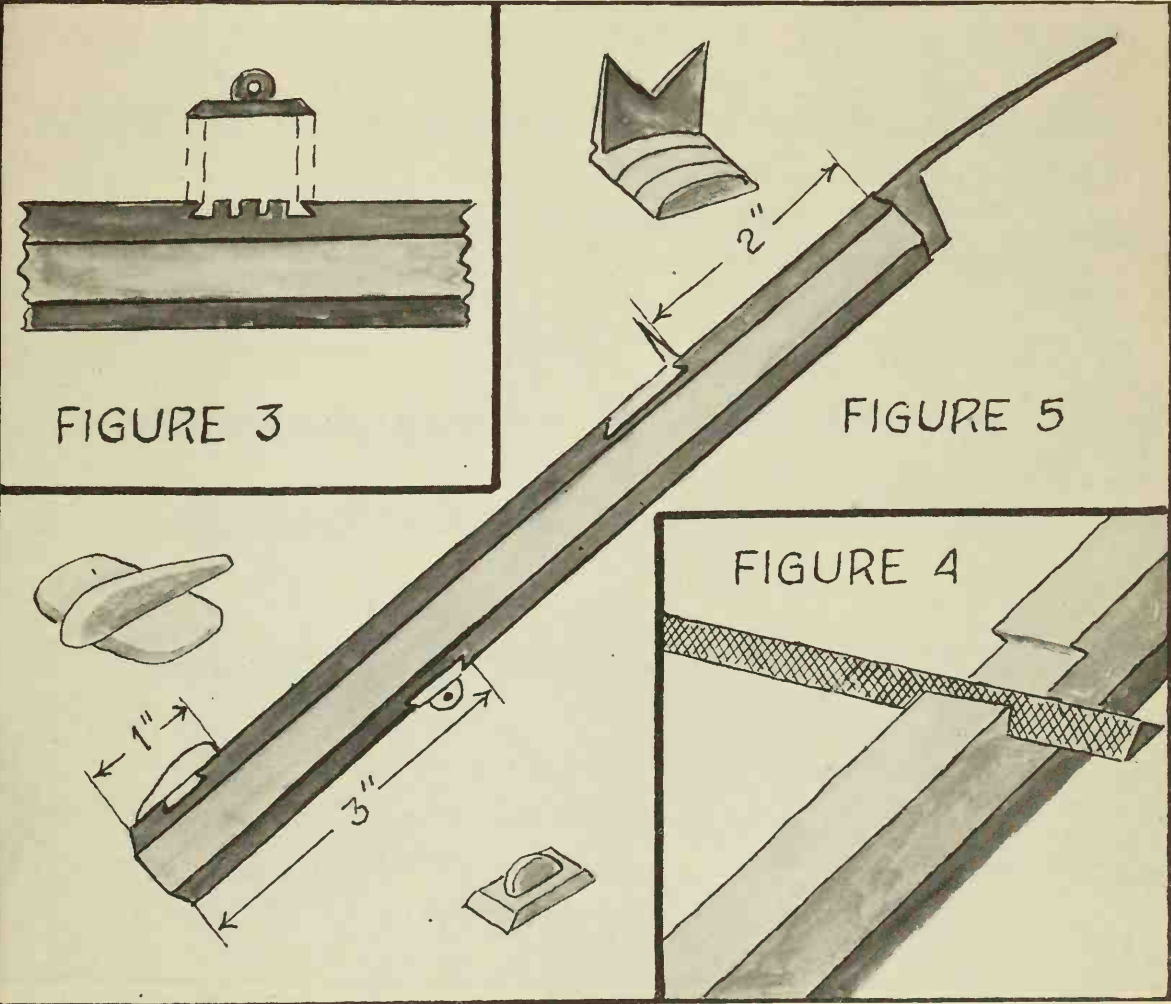


Photo courtesy of Dixie Gun Works

Dovetails for barrel tenons and front and rear sights must be carefully hand-filed after roughing out the slot with several parallel saw cuts.

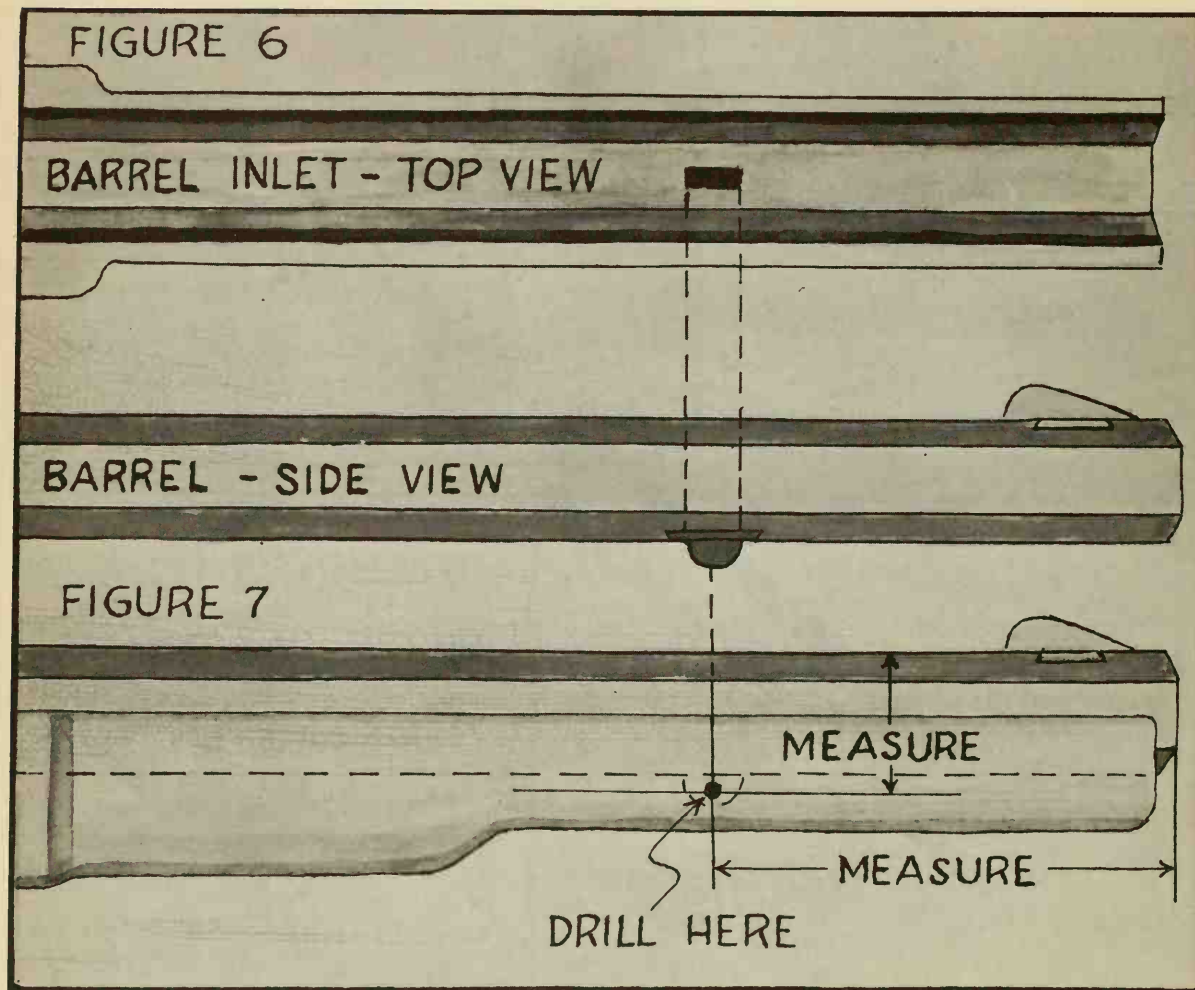


Photo courtesy of Dixie Gun Works

After tenon is fitted to barrel, it must be closely inletted into bottom of barrel channel in stock, and then drilled simultaneously with stock for the pin to tie the whole works together.

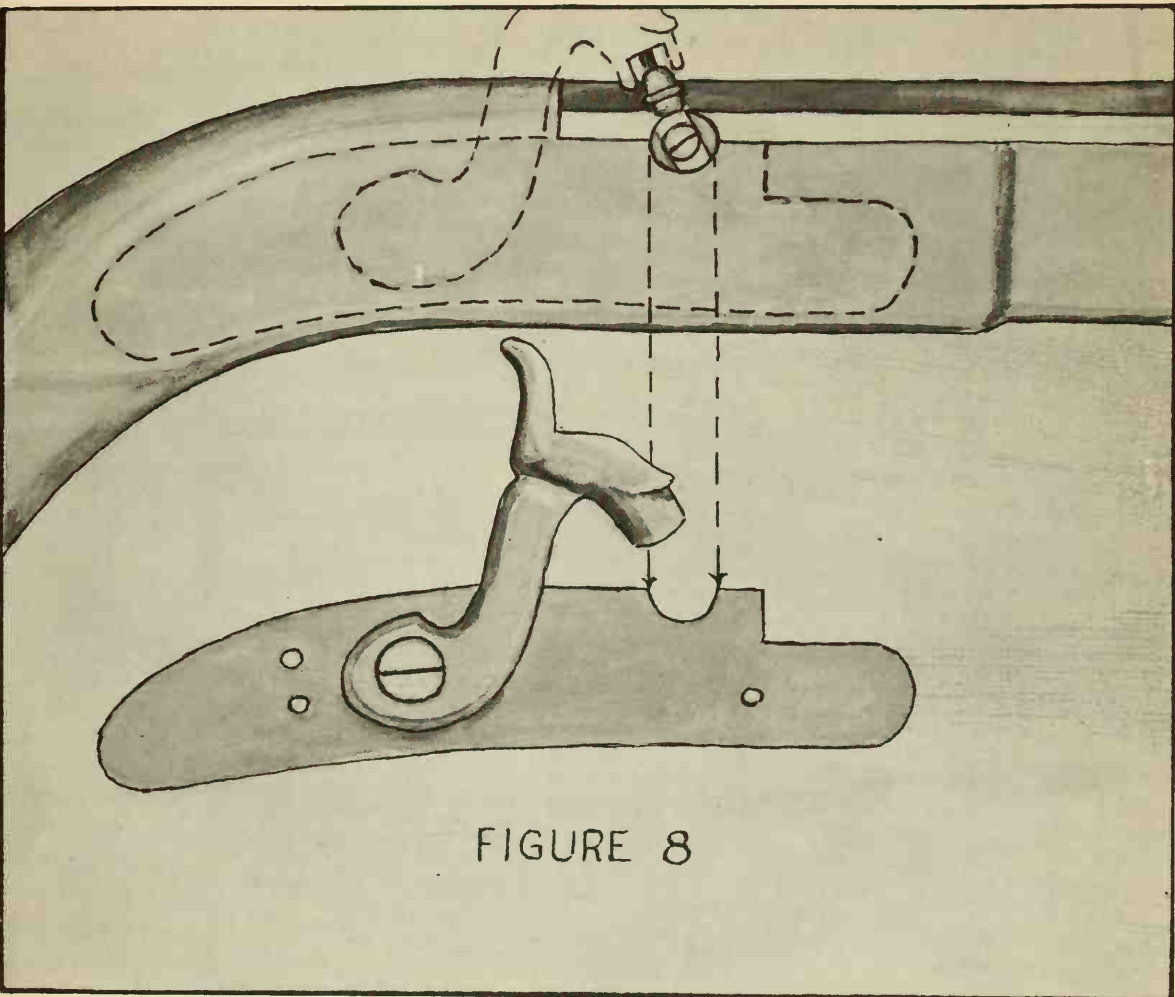


FIGURE 8

Photo courtesy of Dixie Gun Works

Before the lock plate can be properly positioned on the stock for inletting, a groove must be filed or ground in its upper edge to accept the bolster in the percussion version of the pistol.

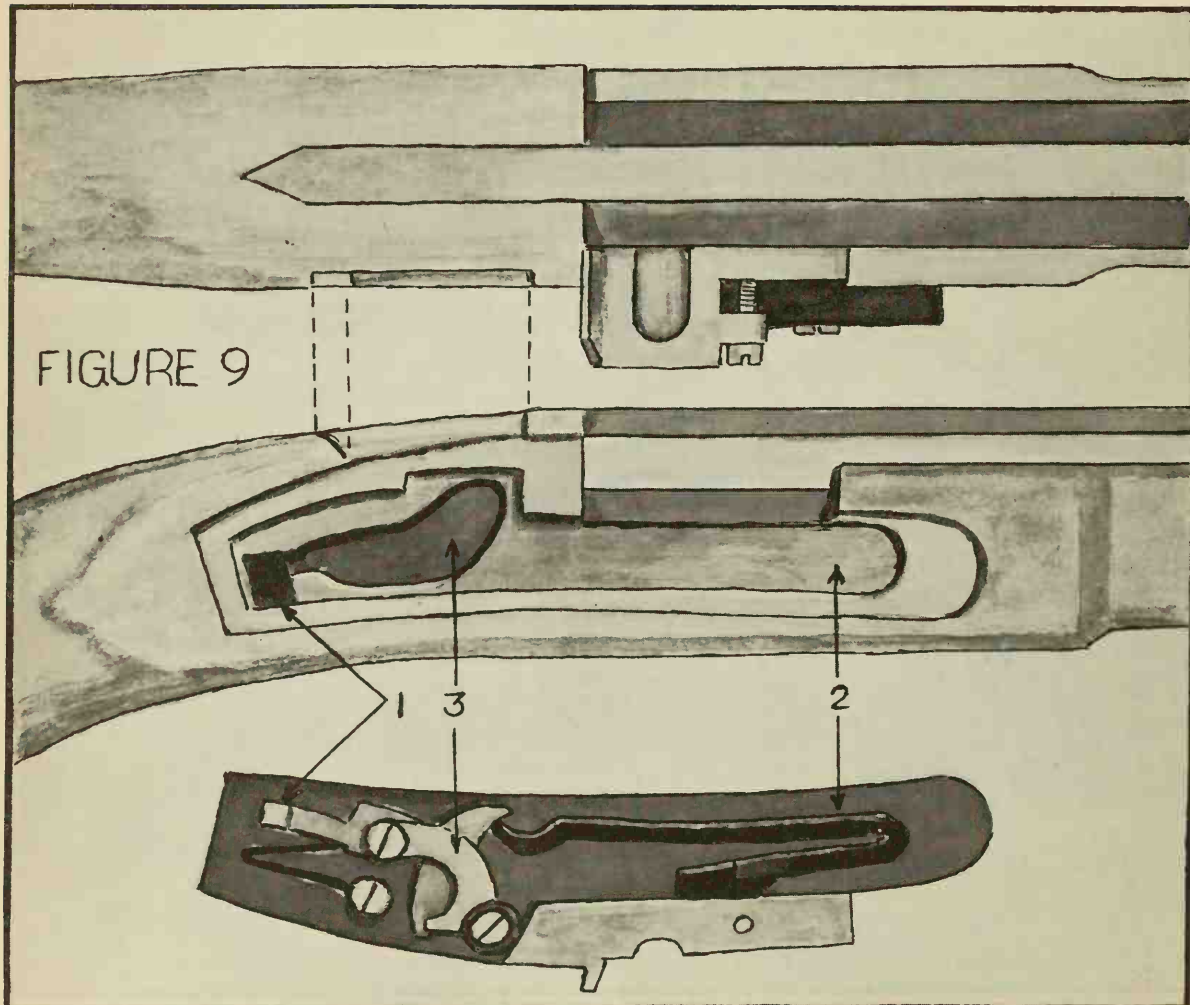


Photo courtesy of Dixie Gun Works

After the lock plate is aligned and inletted, the internal parts are again assembled upon it and wood is removed from the stock to provide clearance for them. Only the necessary wood should be removed—just gouging out a big hole seriously weakens the stock.

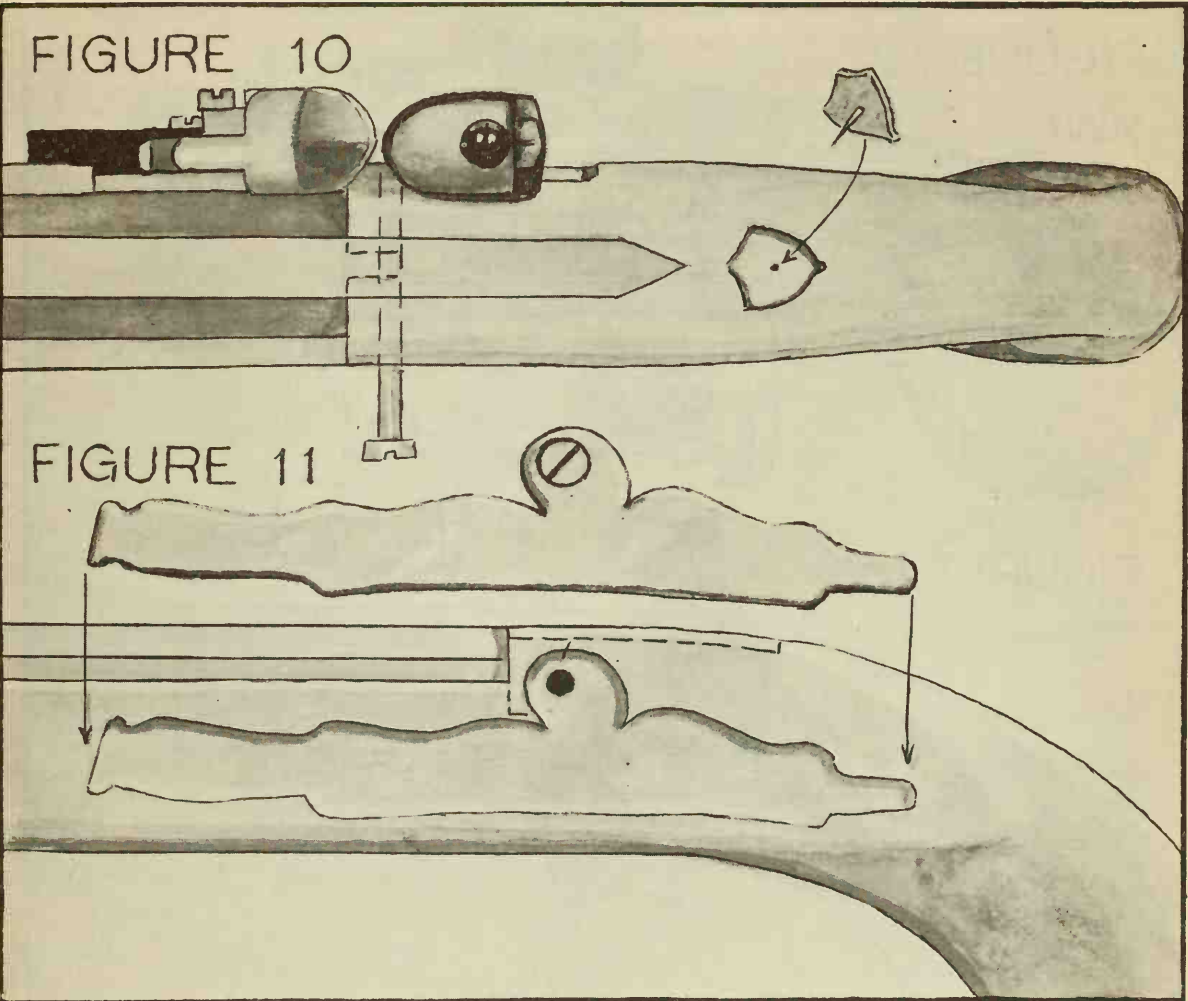


Photo courtesy of Dixie Gun Works

A shield for name or initials may be inlaid into the upper part of the wrist behind the tang after the lock and side plate are fully inlaid and assembled.

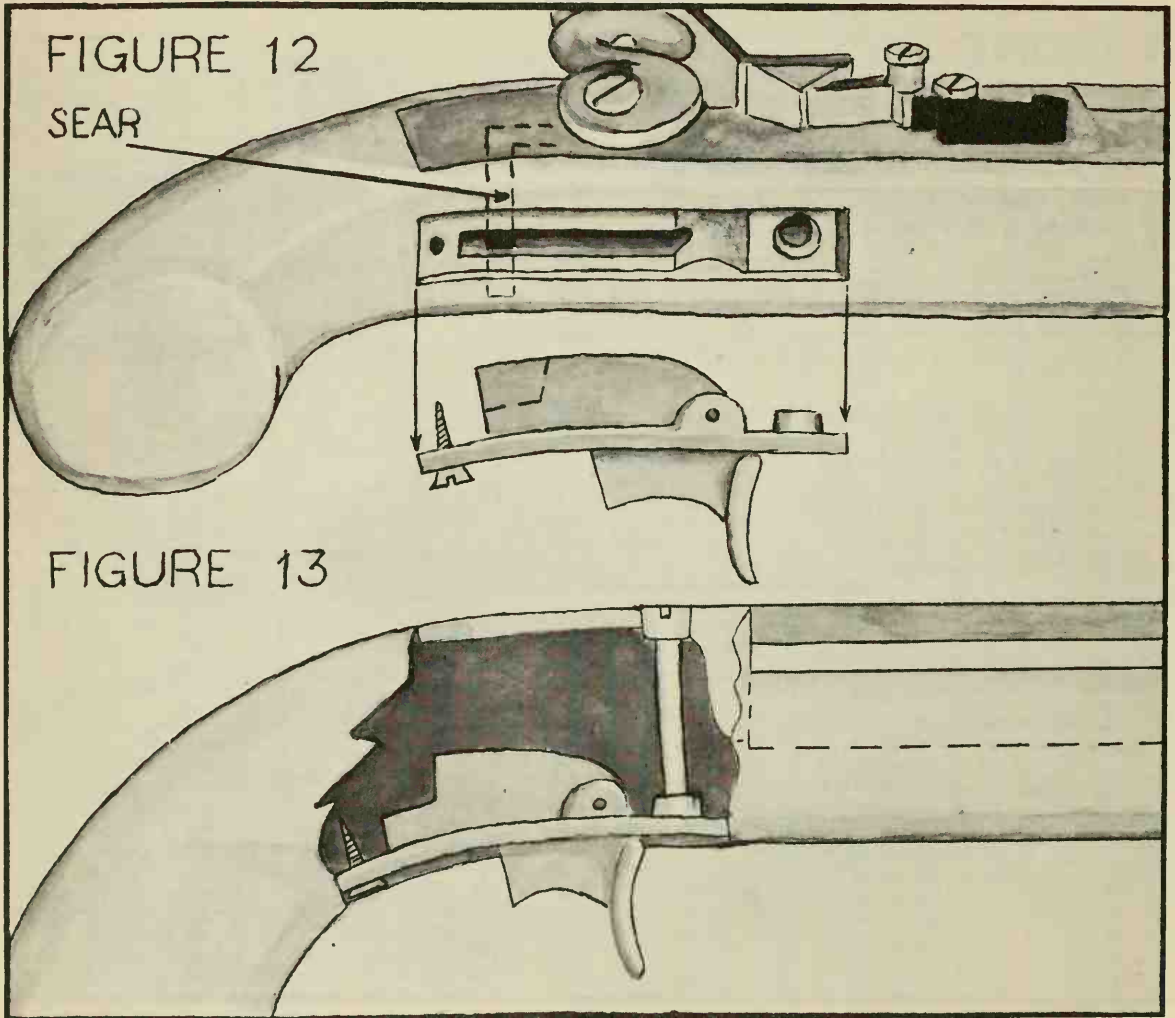


Photo courtesy of Dixie Gun Works

The last step in getting enough parts assembled to the stock to make everything function is inletting of the trigger and trigger plate. They must enter the stock vertically and be held securely in place by tang screw and the small wood-screw shown above.

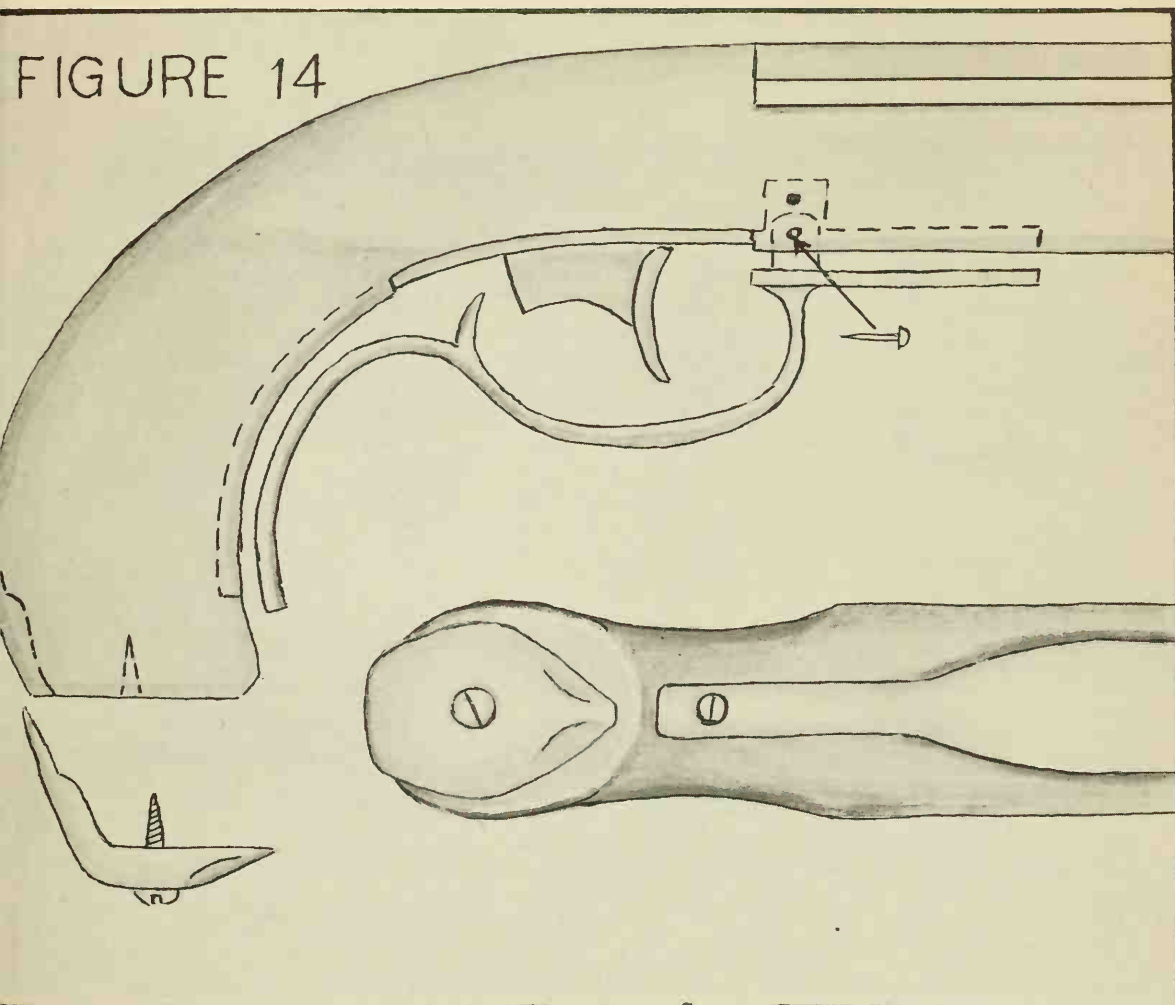


Photo courtesy of Dixie Gun Works

The trigger guard is pinned in place the same as the barrel, but since there is only the one pin, a woodscrew is necessary at the end of the rear tang. Another at the front tang is also a good idea. The butt cap is inletted just as the butt plate on a rifle, but is held in place by a single screw through its center. Extreme care is required here to get a good, close wood-to-metal fit.

FIGURE 15

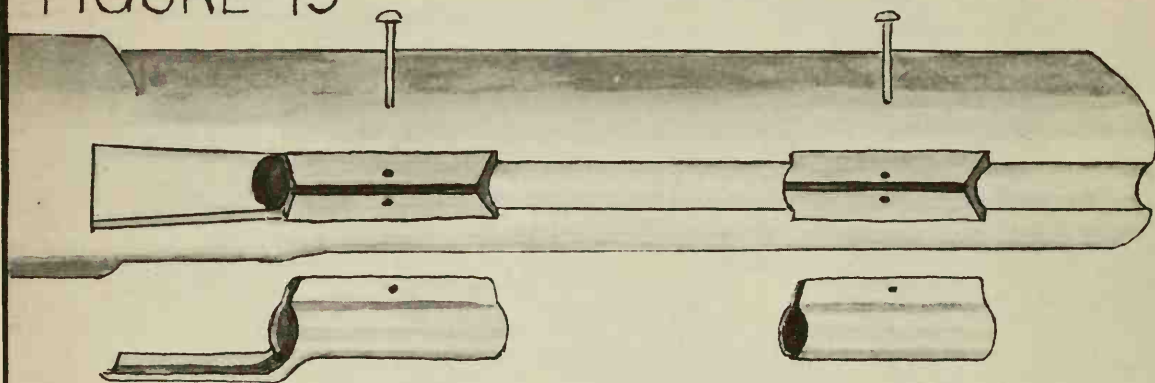


FIGURE 16

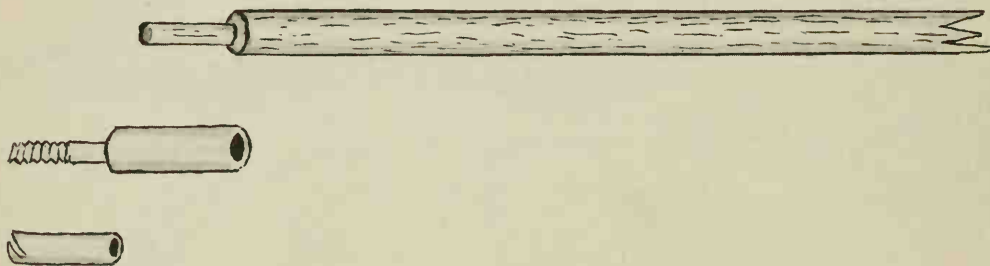


Photo courtesy of Dixie Gun Works

Only two ramrod pipes are required on the pistol. Make sure they line up with each other and with the ramrod groove, and that too much wood is not removed. Since this is a non-critical area of inletting, the common tendency is to get too sloppy.

FIGURE 17

VENT

MEASURE MUZZLE
TO BREECHPLUGDRILL VENT
ON ANGLE*Photo courtesy of Dixie Gun Works*

Though the vent location should be center punched before inletting the lock, leave drilling until last so that any necessary corrections can be made in hole location. Remember to angle the hole slightly forward so that its full diameter emerges into the bore just barely ahead of the breech plug face.

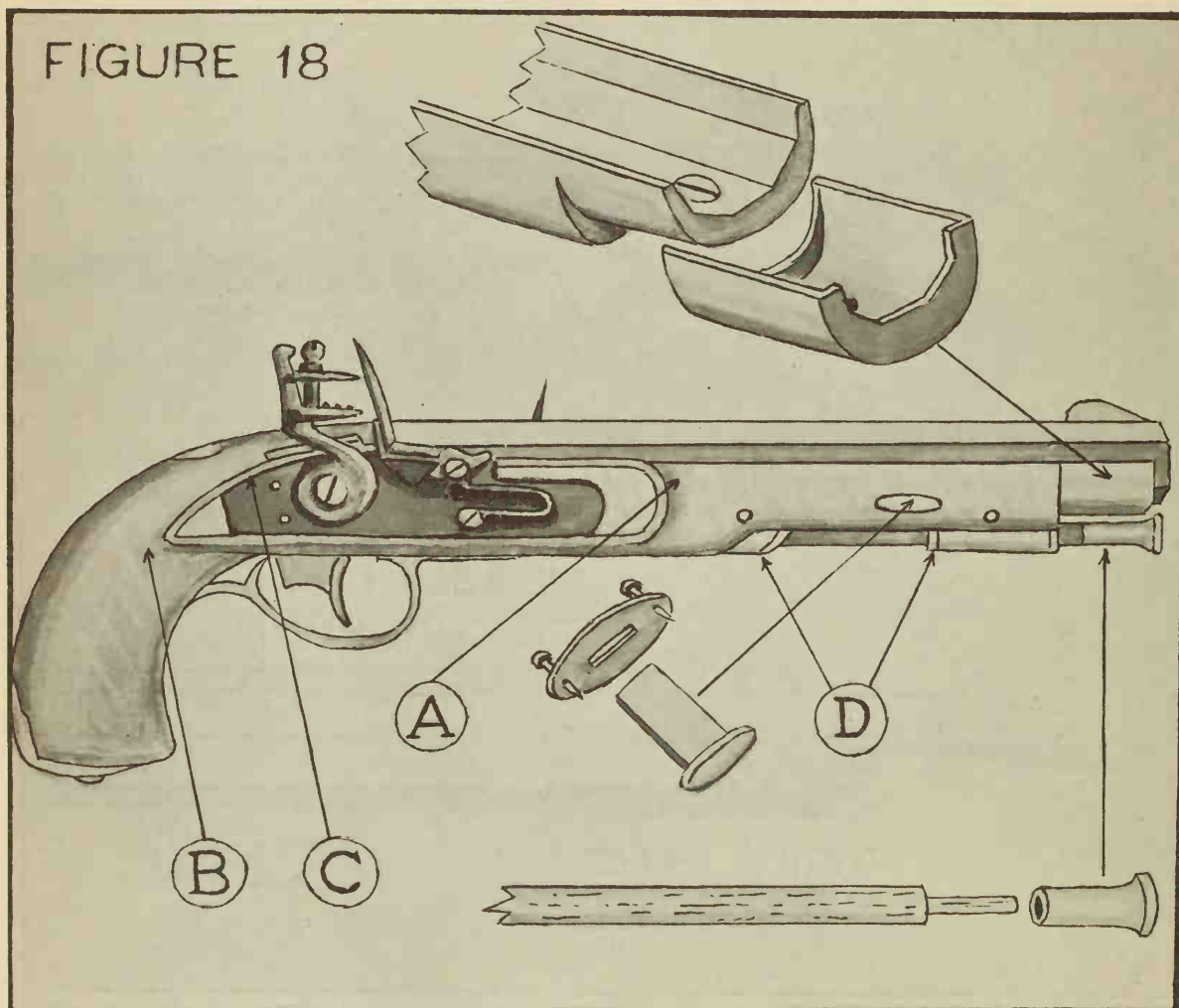


Photo courtesy of Dixie Gun Works

A great deal of effort and time can be spent in finishing up the pistol and giving it a bit more class. Decorative inlays, fancy ramrod tip, nose cap, and all sorts of other items can be added—even substituting a wedge for the barrel fastening pin.

But, it may be that you'd just like to build a shootable, accurate pistol as cheaply as possible without particular effort to make it a duplicate of an original type. This may sound like quite a chore on the surface, but really isn't if you think things out beforehand.

What do we need? Of store-bought items, a lock and a barrel, principally. Almost everything else *can* be made with hand tools, so let's try it that way, just to see how simple the job can be kept. The result won't be fancy, but it will shoot as well as a new gun from a top maker.

Scrounge around in the gunshops you know, looking in scrap boxes for 9 or 10 inches of usable rifled barrel of .35 caliber or over. It shouldn't be too hard to find a damaged 9 mm (.35), .375, .44, or .45 barrel for next to nothing. If that doesn't work, write some of the big surplus dealers and ask for an 11mm or similar barrel. Some of them still have good U.S. .45-70 barrels which work beautifully. If you have much choice, I'd recommend a .45-70, 11mm Remington or 11mm Mauser barrel.

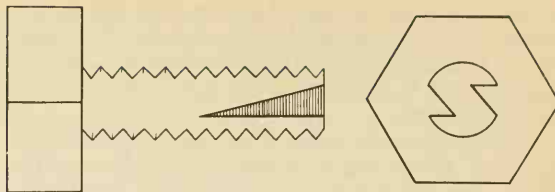
Saw off about a foot of the barrel near the breech, eliminating the chamber if present. Stick this in your pocket and go shopping for a breech plug. At the hardware store, look for a cap screw that is about the same diameter at the bottom of its threads as your barrel is at the bottom of its grooves. Get one screw this size and about 1½" long. You'll only need a fraction of that length in the completed gun, but the extra length is for a purpose, so don't neglect it. Get another short screw that has a diameter about 2/3 that of the bore. Get this one with a head as thick as possible.

Take all this home and lay out your files, drills, and a hacksaw. Try to borrow taps to match the threads of the bolts you bought, but if this isn't possible, don't fret.

First, file the breech end (thickest, if there's any difference) of your barrel flat and square with the bore. If a tap is available to match the biggest screw, cut threads in the bore about ½" deep. The tap won't cut full threads clear to its end, so turn the screw in tight, then back it off a bit. Keep it lubricated and repeat this until it deepens the threads to the full ½". Two or three longitudinal grooves filed through the screw's threads will speed up this operation.

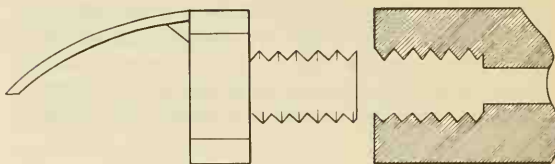
If no tap is available, file the end of the big screw to tap shape, tapering the threads down so it will start in the barrel. In short, make a tap from a bolt — it has been done many times before. The photos show what must be done. Stone the cutting edges a bit. Turn this improvised tap into the barrel ½". Then, shorten it ⅛" and run it in again. Shorten further and turn in again, repeating until you've got a full thread ½" deep.

Now, shorten the cap screw to ½" of thread. This is your breech plug. File a piece of scrap steel to shape for a tang and have it either welded or brazed to the cap screw head as shown. If you own a bottled-gas



If no tap is available, grooves such as this filed in a cap screw will allow it to function as a tap well enough to cut breech plug threads in one barrel.

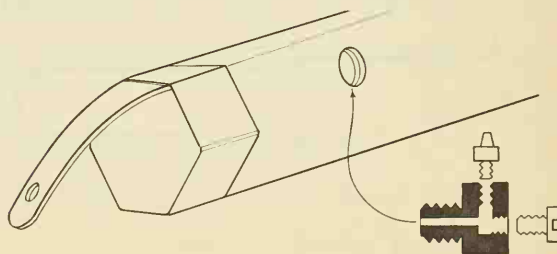
torch, do the job yourself with silver solder and save the welder's fee. Turn this breech plug/tang assembly tight into the barrel. If the latter is octagonal, align and fit the plug as outlined to blend lines of barrel and breech plug together neatly.



A breech plug made from a screw will look something like this when ready to screw into the threaded barrel. Not a thing of beauty, but it will work to perfection and costs little but labor.

The bolster or drum comes next. Just ahead of the face of the breech plug, center punch the barrel at right angles to the bore; also at right angles to the top of the tang. Drill a hole through the barrel wall very slightly larger than the other screw's diameter at the bottom of its threads. Tap threads in this hole as was done to fit the breech plug. Shorten the screw to the thickness of the barrel wall and turn it into the hole tightly. If necessary, file a flat on the barrel around the hole so the screw head will seat solidly.

Center punch the head of the screw and drill a ⅛" hole through it full length. Thread about the first ¼" of this hole to take a convenient screw to form the clean-out plug.



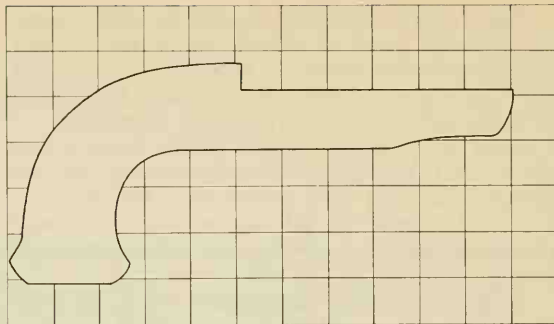
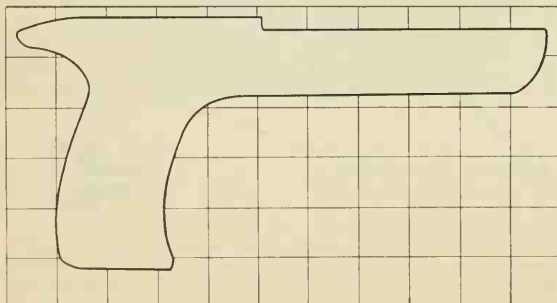
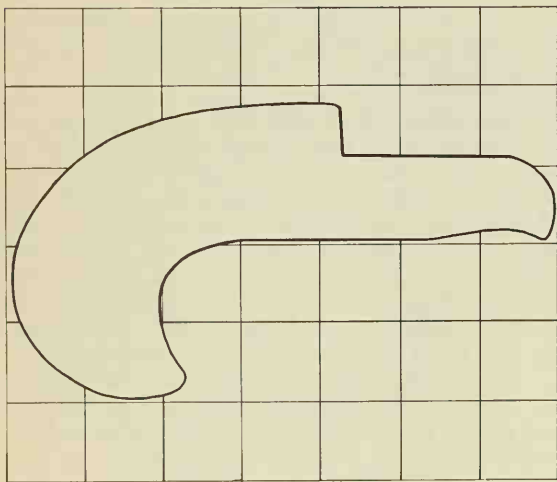
The drum or bolster is easily made from two cap screws — one for the bolster proper, the other to form the clean-out screw. The section shows how the large screw is drilled and tapped to form the bolster.

Select a nipple size that the screw head will accommodate and drill and tap the nipple hole. This might best be saved until later so that the nipple and hammer locations can be matched up to get proper contacts and good ignition.

Now, saw off the barrel at the muzzle to the length you want. To my way of thinking, 9" or 10" overall is plenty. True the muzzle up carefully, then chamfer the bore mouth lightly and break the sharp outer edge a bit with the file. For all practical purposes, that completes the barrel.

There's no point whatever in trying to make a lock. Sound new locks are available as cheaply as \$6.50. Sure, they need polishing and a bit of tuning, but that's a lot less trouble than trying to make one. Be sure and order the pistol size lock. Get a back-action type if you like, but the typical side lock is less trouble to fit and will allow you more leeway in stock shape.

You'll need to have a stock before the lock work can be done. Several styles are shown, laid out on 1" square grids to enable you to easily prepare a full-size pattern. Select the one you want and make a pattern, scaling the fore-end to suit the length barrel you've chosen.



Pick out a piece of wood about 1 $\frac{3}{4}$ " thick and big enough to fit the pattern. If you like things the easy way, a length of 2" x 6" pine or fir will make a usable stock. It won't be pretty, but it will be cheap. In fact, you can probably pick up an end cutoff at the lumberyard for nothing, and, it's easy to whittle to shape. Personally, I prefer maple or walnut, but that's up to you. Maybe the best idea is to make the stock first from pine; then later if you decide upon some changes, make the new one from better wood.

Trace the pattern onto the wood. Either have the stock band sawed to shape or cut it out with a coping saw. Plane the top edge smooth and square, and then draw a center line down its full length. Place the stock blank in a vise and lay the barrel over the center line. Trace around the barrel, turning the pencil slightly inward so as not to make the outline too large. Use round gouges or rotary files in a hand grinder to rough out the barrel channel full length. Take care not to go outside the lines.

Smoke the barrel and tang and drop into the rough channel. Tap with a mallet to make a good impression, and then lift out. Soot on the wood shows where more must be cut away. From this point onward, inlet the barrel and tang as described for the rifle. Go slow and easy and sink the barrel level — not high or low at one end — until it is $\frac{1}{2}$ its diameter into the wood.

Clamp the barrel tightly into the stock and drill a hole in the tang for a brass woodscrew of convenient size. Countersink and run the screw in tightly. Tie the barrel to the wood at the muzzle with soft wire or reinforced tape as temporary measure.

Fitting the lock is next. Lay it on the side of the stock and carefully eyeball it into position. It must be aligned so that when inletted the hammer will line up with the nipple. The arc described by the center of the hammer face should pass through the center of the bolster, viewed directly from the side. Take care with this alignment, for once the lock is inletted, you'll play the devil shifting it without ruining the entire stock.

Clamp the lock in place and trace around it. Cut just inside the lines with a sharp knife and start removing wood. This procedure, too, is covered in the

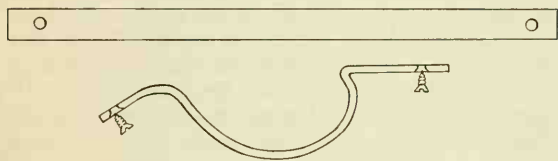
rifle chapter, so we refer you there for details. Since we started inletting before the outside of the stock was shaped, the lock will have to be seated *below* the surface of the wood in order for the hammer to line up with the nipple.

If your lock is of conventional design, next inlet the side plate and fit the lock screw described for the Dixie Rifle Kit. If attachment is different, make sure you understand it thoroughly before cutting into the stock.

Now is the time to carve away all the surplus stock wood. A model maker's plane, sharp knife, and Stanley "Sureform" rasp are all that's needed for this. Try the gun often while shaping the grip area or you may wind up with a shape you don't like. "Feel" is more important than looks in this area.

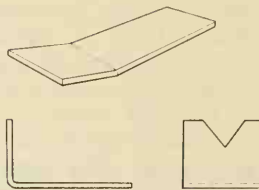
With the stock shaped nearly to final dimensions, the trigger must be fitted. You *can* make a trigger from a nickel's worth of steel — but a complete trigger and plate assembly costs only about \$2.75, so you'll be money ahead to buy one. Inlet and regulate the trigger as already described for the Dixie rifle except that there won't be any tang bolt threaded into the plate. Use a single wood screw there instead.

Fancy trigger guards are for sale, but for a basic gun like this, we don't need one. Cut a strip of 1/16"-thick brass and bend it as shown. Taper it toward both ends and bevel or round the edges for a more graceful appearance. Drill holes in both ends then inlet them flush into the stock. Attach the guard with brass wood-screws and another job is done.



A simple trigger guard is easily made by bending a plain piece of strip brass (or any other metal) to the shape shown, and then drilling a pair of holes for attaching screws.

Disassemble lock and barrel from stock. Bend a rear sight from sheet metal as shown and lightly mark the center of its leaf. File a front sight from brass or coin silver and silver solder it in place. Silver solder the rear sight in place also, aligning it with the front blade. Don't cut the rear sight notch yet. Solder or dovetail a tenon on the underside of the barrel, and then inlet, drill, and pin it as outlined for the rifle.



The simplest form of rear sight. Can be bent and filed from a piece of strip metal in a matter of only a few minutes. Solder or screw to barrel.

Remove barrel and do the final shaping and sanding of the stock. Scrape and sand carefully to produce as smooth a surface as possible. Then, whisker and apply your favorite stock finish.

Go over all steel parts now, polishing out file marks and carefully scraping away any excess silver solder. Polish all by hand, and then brown or blue as suits your fancy. For a gun of this type, I recommend quick-acting G-66 paste bluing compound. It produces a good blue finish in a minimum of time if used according to directions.

Bolt everything back together and it's ready to shoot. Snap a cap or two on the nipple and load up with, say, 20 grains powder in .45 caliber, 15 grains in .36, and a patched round ball. Remember that there's no notch in the rear sight yet, so as you shoot, file it in so that she shoots plumb center at 25 yards.

Once you've gotten this far, there really isn't much more you can do except learn the gun's habits and how to get the most from it. Of course, it may not look like much, but it was so cheap and easy to build that you'll probably do another one next winter — and it *will* be a beauty!



Chapter 15

CLEANING & PRESERVATION

Here and there in this book we've touched on cleaning of muzzle loaders as it was applied in a particular instance. Here, we'll lump together all the cleaning information we've gleaned, and you can pick out that which suits your guns, circumstances, and temperament best.

Black powder shooting is messy, any way you look at it. The large quantity of solid residue generated when the powder burns is black and sooty and clings to everything it touches. It makes the gun and shooter look as if they'd just crawled through a chimney. The residue is highly hygroscopic — it absorbs moisture from the air rapidly. Where the fouling lays on metal, this moisture will cause rust to begin in a matter of hours. Black powder guns shot in a humid climate must be cleaned no later than the end of that same day. If they aren't, you can bet a bottle of your best scotch whiskey, they'll be red with rust by the next morning. Out in the desert country, there is very little moisture in the air, so rust takes much longer to form. Guns have been found in the desert still in good condition after laying in the sand for scores of years.

Avoiding the pitting effect of rust on bores and working parts is plenty of reason for prompt thorough cleaning. But, there are other reasons. A dirty fouled bore is less accurate than a clean one — primarily due to the solid particles clinging to its walls. Excessive fouling cuts patches, deforms bullets, and in some instances, makes loading virtually impossible. The bore isn't all that suffers. Fouling that has collected in the nipple or bolster passage can spoil ignition, even cause misfires or hangfires.

Allowed to collect on lock parts, it can cause springs and screws to rust through. Accumulating in bolster, nipple, clean-out screw, or breech plug threads, it can cause them to rust so badly the part may some day blow right out of its seat as a shot is fired. Working unnoticed down between stock and barrel, fouling will cause massive rusting of metal and rotting of wood. It can creep into a minute metal flaw, suck moisture from the air, and eventually rust a hole through the barrel.

If it seems I'm over dwelling on the consequences of improper cleaning, it's for a reason. The finest black powder gun can be completely ruined in just a few days if fired and put away neglected. In the days when *all* guns had to be thoroughly and frequently cleaned, this wasn't likely to happen. But, with today's smokeless powder ammunition, modern rifles, pistols, and shotguns are often shot for a whole season — even a year — without ever being cleaned. And, they survive undamaged very well. With a few generations so conditioned to minimal, if any, cleaning, it's too easy to think "I'll clean it tomorrow." When tomorrow comes, something interferes, and by the time the job is remembered, a fine black powder arm is completely ruined by that Red Devil, Rust.

How to clean? Simple. Black powder fouling is soluble in water. For centuries, it has been washed out or wiped off with a wet rag or patch. Old timers used tow twisted around a "jag" on a "wiping stick," or into the worm on the ramrod. A slotted tip was also used to hold a piece of cloth for wiping the bore. I find wrapping a patch around a bore-size bristle brush to be most convenient. The patch will often come off a jag or slotted tip and remain in the bore — a most frustrating occurrence.

Today, we have "black powder solvents" that can simply be sloshed on the fouled areas to provide rust protection for weeks or more. "Blacksolve" and "Gun Juice" are two common trade names. If you come in beat from a day of shooting and mama has you lined up for an immediate bridge or dinner commitment, these mixtures can be sluiced over the entire gun in a few seconds. They will protect it perfectly until the cleaning can be attended to properly. Some shooters just leave the gun like that until next shooting time, then swab it out and wipe it off. I've tried that a time or two, but it's too messy.

Garden-variety (but thorough) cleaning of an assembled front-loading long gun is not difficult — just a bit more time-consuming and messy than for a breech loader.

Lean the gun, muzzle-up, against bench or table

(better yet, clamp it somehow in that position). Cock the hammer and slip a piece of neoprene surgical tubing over the nipple. Run the tubing into bucket or basin or some sort of drain. Keeps the mess off the floor, but its main purpose is to keep sooty water from soaking into the stock. Wrap an old towel around the barrel just below the muzzle to catch splashings and drippings. Take a bristle brush (not a *wire* brush) on a steel cleaning rod, dip it in hot water and swab the bore full length. Just a few strokes will loosen most of the fouling. Switch to a close-fitting patch or flannel mop and repeat with plenty of water.

Use a funnel to fill the bore with hot water which will slowly run out the nipple. Keep adding water until it comes out of the nipple clean and clear. Let barrel drain, but not long enough for it to get cold. Swab bore dry, then oil while metal is still warm.

Next, remove the tubing and with a damp cloth wipe off any fouling around the breech area. Use an old toothbrush to get in around the base of the nipple, snail, etc. Don't overlook *any* crevices. Wipe everything dry. Lightly oil metal and, if needed, rub a bit of paste wax or your favorite linseed mixture on the stock to refresh its beauty.

When this method is used properly, not a drop of murky water will get on the stock or seep between metal and wood to cause rust.

A variation on this method is to remove the nipple or clean-out screw and replace it with a fitting, containing as large a passage as possible to which is attached a neoprene tube. The tube is placed in a bucket (or the bathtub) of hottest water. A tight fitting patch or combination of patch and brush is then worked up and down in the barrel to pump water in and out. When all the fouling appears to be gone, clean water is used for a final rinse.

Another trick consists of the same drain arrangement just mentioned, combined with a hose slipped over the muzzle, leading running hot water to the bore direct from the tap. The fouling is first loosened with a wet brush, then fast-running hot water does the rest.

Yet another gimmick consists of a barrel length metal or plastic tube of about $\frac{1}{2}$ bore diameter. The gun is held nearly level, but muzzle down, and the tube is inserted up the barrel to the breech plug. The tube is connected by a hose to the hot water tap. Water flows up the barrel tube, bounces off the breech plug and flows back out the muzzle, carrying the fouling with it. A nipple tube should be used to prevent water spurring out onto lock and stock. All of these running water methods still require initial loosening of the fouling with a wet bristle brush.

No doubt there are other variations on the hot water theme, but any of the foregoing will get a bore as clean as it can be gotten. I find it useful to add just a touch of non-sudsing detergent to the cleaning water, but I suspect its value is more psychological

than real — except where the fouling has become solidly caked. Incidentally, should you suddenly discover that you *did* let a gun go uncleaned several days, fill the bore with water and let it soak a few hours before getting panicky with rod and brush. The cleaning will go easier after the fouling is soaked soft.

Careful drying and oiling is essential after water cleaning. The main reason for using hot water is that it heats the metal which then speeds drying when the job is finished. As noted elsewhere in this tome, I normally dry revolvers in the kitchen oven after cleaning — then I *know* no water is trapped somewhere in a screw hole or recess. This isn't practical with long guns, so extra care should be taken to insure everything is dry. Applying oil while the metal is hot causes it to penetrate and provide maximum rust protection.

People have their favorite oils and greases to keep their guns fresh and bright from season to season. "Rig" is an old favorite, as is the old B.S.A. "Saftipaste." But the new aerosol cans of synthetic lubricants and preservatives are much handier to use and provide excellent protection. I've found the "Anderol," "Stoegerol," and "G-66" products all to be very reliable.

When using the patent cleaning mixtures, care should be taken to see they aren't slopped over the stock. Some will harm the finish, others won't. If used to excess, they'll seep into the wood at inletting cuts, weakening the stock. My only real objection to them is that they encourage hurried, sloppy cleaning by virtue of their ability to prevent rusting even if the fouling isn't removed.

Of course, cleaning time is inspection time. Screws and pins must be checked for tightness. Nipple and bolster likewise, along with every other component that is accessible without further disassembly. Repairs or replacements should be made as soon as discovered. Putting the work off only amplifies the defect. Occasionally, especially if the gun has been out in the wet, a complete disassembly is in order. Clean and grease all parts covered by wood, and restore the wood sealer, if necessary.

Stocks need occasional cleaning. Powder fouling must be wiped off after every shooting session or it will work into the wood and ruin the finish. When the stock is just plain dirty, a soft bristle brush or coarse cloth and mild soap will clean it quickly. Use a "dry" lather with as little water as possible. Then a bit of paste wax rubbed on and buffed gently will restore that deep satin gleam. Check the Chapter on stock making and repairs.

A gun properly cleaned and cared for will last through a pair of lifetimes — but one neglected won't see you through a single season.

Chapter 16

COMPETITION AND GAMES

Simply lining up on the range to fire a muzzle loader a few times at a conventional paper target is fun. But, it's a rather prosaic test of skill among the thousands of black powder buffs from California to Maine and Mexico to Canada. They like more color and dash.

Someone showing up at a formal rifle or pistol club range clutching his long rifle and powder horn isn't going to get in much shooting. He'll get lots of conversation, interspersed with a few gibes, but a few demonstration shots are about all he'll be allowed. There simply aren't any recognized matches he can shoot in, except where his black powder brethren gather on their own ground. There, if you've never seen it before, you'll observe some most interesting shooting — both for fun and for keeps.

The lone front-loader owner can get in his shooting only if he has access to spacious farm or woodland. If he's cooped up in a major city, there simply isn't any place to shoot. The real backbone of shooting is the dozens of small clubs and the various State muzzle-loading associations. Wherever at least three shooters can get together, they can eventually form a club. Once that's done, assiduous digging will eventually produce a place they can set up target boards and shoot, even though it be only some friendly farmer's creek bed.

If you want to shoot and don't know of a club from which to get assistance, immediately get a letter off to the National Muzzle Loading Rifle Association, P. O. Box 15, Friendship, Indiana 47021. Ask about clubs and ranges in your vicinity. And, just in case no club does exist, ask for instructions on forming your own club. If it comes to that, don't despair. Just visit all the gun shops and ask for names of people who've bought muzzle-loading guns or are known there to be shooters of same. Armed with that information and a telephone, you're a damned poor salesman if you can't get a club started in a single evening.

From then on, it's just a matter of setting up the club and affiliating with the NMLRA. As soon as you have an organization, you can start scouting for a suitable shooting site. Black powder shooting doesn't require a fancy setup. Just room for a few firing points,

50 yards clear range, a solid backstop, and permission to shoot there. The rest, benches, target frames, etc., can be put up in a weekend or two. Incidentally, abandoned gravel pits and strip mines often make good range sites, even though not big enough to suit the breech-loader boys. Old levees and embankments make good backstops, too.

There's enough written elsewhere on range building that you can find the information if you need it. Contact the NRA or NMLRA for help.

But, let's get down to the type of competition you'll find among black powder shooters. There are many types of matches, each tailored to suit a particular type of gun.

Informal Sunday-afternoon (after church, of course) local shoots are usually confined to "shooting the mark" in the old time way. Targets consist of an "X" on a board or paper and firing is from the prone position with rifle rested across a log or similar support. Matches may consist of a single shot from each competitor, the winner being the one who places his ball nearest the center of the "X". For the Fourth of July and similar occasions, meat shoots are held under somewhat different rules. Each shooter may fire as many shots as he likes, paying the entry fee for each one. His best shot goes for record. Who, cares if a fellow spends five bucks to win three dollars worth of bacon? I've seen it happen that way many times.

Plain off-hand shooting is another mainstay of the game. It may be for score on ring targets, for group size, or to "cut the X." Rapid fire off-hand matches are great sport, both for shooters and spectators. Usually two shooters or two teams square off against a given number of breakable targets. The glory goes to the side breaking all its targets in the shortest time or breaking the most targets in a given time. Clay birds and small balloons are popular targets.

Spice is added to rapid-fire matches by using a single, long row of clay birds. The two competitors start at opposite ends and shoot successive targets toward the middle. The shooter can earn bonus points if he breaks all his targets. Then he gets into his oppo-

ment's share. Some pretty spirited competition can develop in this game. Speed isn't in the shooting as much as in loading and more than one rushed competitor has shot his ramrod targetward.

When really experienced hotshots get together, a few more interesting games are played. Probably the most spectacular consists of "Shooting the Axe." Here, an axehead is secured to a suitable backstop — often a stump or log-end into which one edge of a double-bitted axe is sunk. Two clay targets are placed straddling the axe. The object of the game is to hit the sharp axe edge with a bullet, causing the two bullet halves to splay out to hit and break the clay birds. Sure, it can be done, but even at close range, it's no piece of cake.

Another one consists of "Cutting the Stick" or "Cutting the Stake." Sometimes called a "Stake Shoot."

A pair of wood uprights, which may be anything from a broom handle up to fencepost, are set in the ground. A team or individual is assigned to each upright and on command starts shooting and continues until one or the other shoots his stake in half. Naturally, the winner is the first man or team to "Cut the Stake." With broomsticks or similar targets, this is fine practice for the individual shooter. However, it's more popular as a team event, using rifled muskets. Even a four-gun team firing as fast as it can, takes a while to cut a 4 x 6 timber with .58 caliber minie balls.

Of course, pistol and shotgun fanciers all have their own pet games. Scattergunners shoot trap and handgunners shoot slow and rapid fire on standard paper targets. The latter also have speed and accuracy matches on rows of clay targets and balloons like the rifleman.



Old timers and their front-loading shotguns will surprise you with their performance over the traps. This gentleman has been shooting at the Nationals for years; broke 27 straight in '68 with his 12-gauge caplock scattergun. Who says muzzle loaders won't shoot?



Favorite in revolver matches is the Navy Arms replica of Civil War Remington .36 and .44 percussion revolvers. This competitor has loaded powder and ball carefully and is now filling the balance of the chambers with grease as described elsewhere.



Pistol matches seem fairly popular with the ladies, and this one doesn't do badly. Note modern, straight-line, speed-lock percussion pistol.



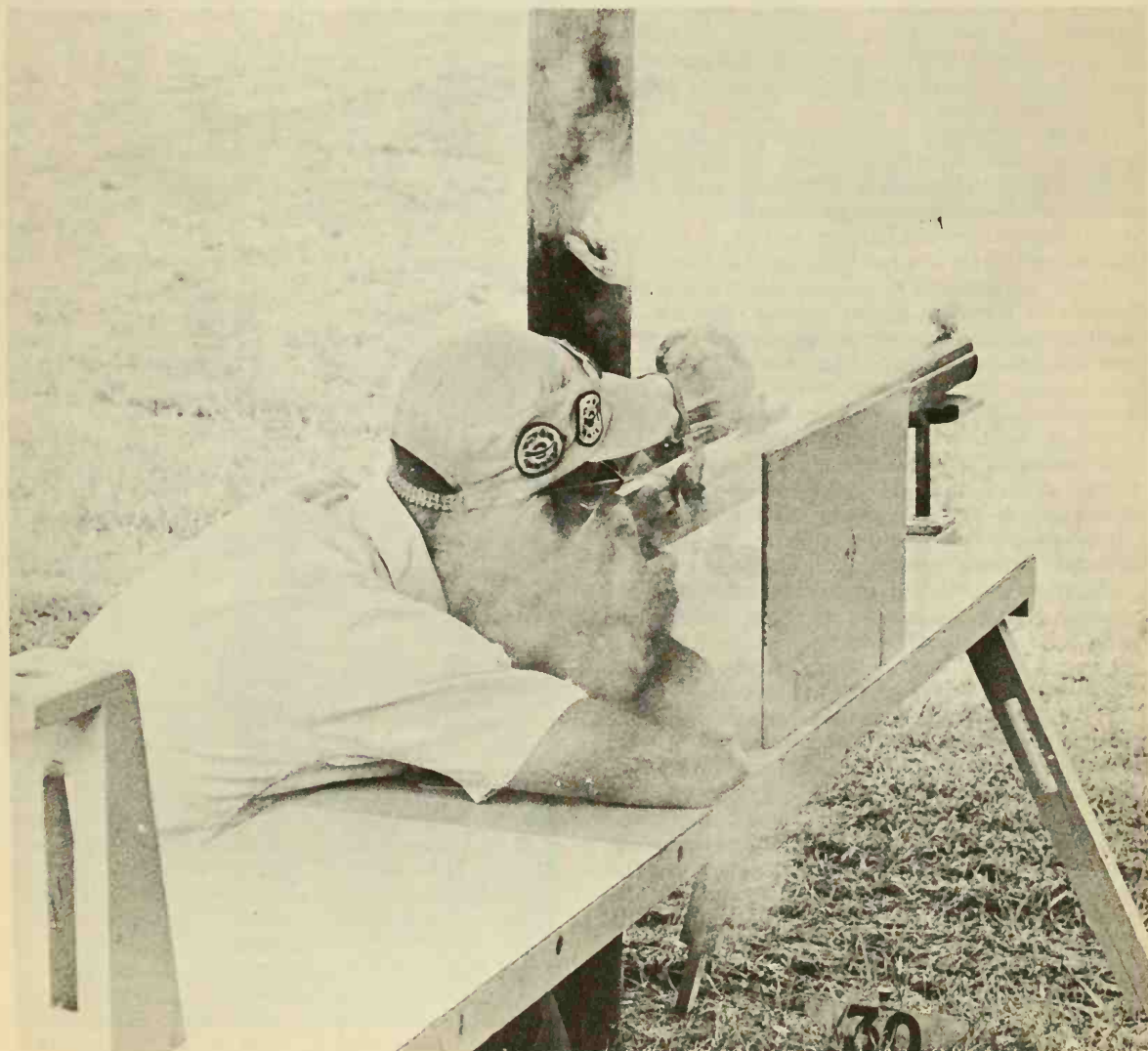
The National Muzzle Loading Matches now even have an official piper. This isn't unusual when one considers bagpipes were not uncommon on the frontier in the 18th Century.

The bigger clubs will conduct more formal and extensive matches, often including virtually every game in the rule book. A couple I've heard of even have their own local version of the Seneca described a bit further on.

Best of the local shoots is the State Championship Matches. Even if you don't figure you're good enough to compete at this level, you owe yourself the experience of attending. The knowledge of guns, equipment, and techniques that can be picked up there is invaluable and will go a long way toward increasing your

enjoyment of this grand game.

Two massive muzzle-loading events that take place each year under the auspices and control of the NMRLA — they are the "Spring Shoot" and the "Fall National Championship Shoot." The latter is often referred to simply as "The Nationals." These events occur (as do others of lesser importance throughout the year) at the Association's official home and range just north of the friendly hamlet of Friendship, Indiana. This little community lies about 70-75 miles south of Indianapolis.



Heavy round ball match rifles burn great quantities of powder and literally hide gun and marksman behind a thick white fog. This one, a flintlock, is really smoking things up at Friendship.

Twice each year, the area is inundated by hundreds of the finest people I've ever met — ranging from dirt farmers with an inherited "hawg rifle" to professional men shooting guns costing thousands of dollars. Here gather the elite of the muzzle-loading clan. Here is seen the epitome of development of the muzzle-loading rifle (and pistol and shotgun). Here, they come from coast to coast, even from Alaska and Hawaii — by airplane, camper, bus, car, motorcycle; you name it and somebody came in or on it. You might even find a few horses tied in one of the nearby thickets. The men don't come alone; wives, girl friends, and young 'uns are there in droves. Many of them shoot, others tend the camp chores. Quite a few are in period dress to match "The Mister's" outfit, and cook with gear you'd expect to see in a wagon camp on the Oregon Trail a century back.

Proudly displayed or jealously guarded, depending upon the nature of the owner, there will be hundreds of thousands of dollars worth of the finest original and modern muzzle-loading arms one could hope to see. Modern-day artisans will be there, perhaps plying their tools on the tailgate of a pickup truck or in a tent.

While conventional dress predominates, don't be surprised to come up against a lanky, bearded and moustachioed character in a long-fringed buckskin from head to toe, perhaps even draped with tartan sash, coonskin cap, and bead-bedecked accoutrements. He might even be accompanied by a comely lass who looks as if she just stepped out of a tepee over the hill. Even buckskin mini-skirts, yet!

But in spite of all the sidelights — Tomahawk throwing, knife throwing, trading, and a Little Taos Lightning (consolation for losers after dark) — shooting is their primary concern.

Every imaginable sort of shooting takes place. If I were to pick the three most interesting matches, I'd have to list the "Seneca" at the top because of its color and duplication of frontier situations; the Slug Gun Matches for the superb quality, precision, and accuracy of the equipment used; and, last, the "Buffalo" where shooters rest their buffalo rifles on crossed sticks to duplicate the feats of early hunters.

The Seneca is everyone's favorite, though few compete in it. Shooters must be in authentic frontier dress, which might be anything from breechcloth and moccasins to broadcloth and boots with beaver hat. The match consists of much more than shooting and demands top physical condition. Regular competitors train all year for it.

The course is laid out along a rocky creek that twists up a draw. The shooter is poised at the starting line and at the "Go" signal, moves out running. Up the creek a way he spots a partially-hidden target, stops, loads his rifle, fires and gallops on. Four more targets are up there somewhere, and he must locate and shoot all of them, then return down the creek to



Not only the boys go all out in regard to period costume. There are quite a few other interesting sights, such as this Warrior's Delight perched alongside an isolated stream at the Nationals — maybe she's thinking about a swim; it was a hot day.

the starting line. It's a gruelling 300-yard run through water and gravel and over rough rocks, interspersed with five stops for loading and shooting. If you think it's easy, come on down and try it some time.

Top Seneca runners complete the course in seven to eight minutes and shoot scores in the high 40's (possible 50). Highest score wins, but ties are broken by the fastest run. Its closest modern counterpart is the biathlon where the hero has to ski and shoot his way across country against time. Many a Seneca runner would gladly swap for some of the biathlon men's snow after his August run.

Occasionally, a Seneca runner will gallop off after his shot and drop or leave his ramrod behind. That's



Primitive match competitors at play. While killing time, waiting for a match, they hold impromptu contests in knife-throwing (here) tomahawk-throwing and all other manner of frontier games.

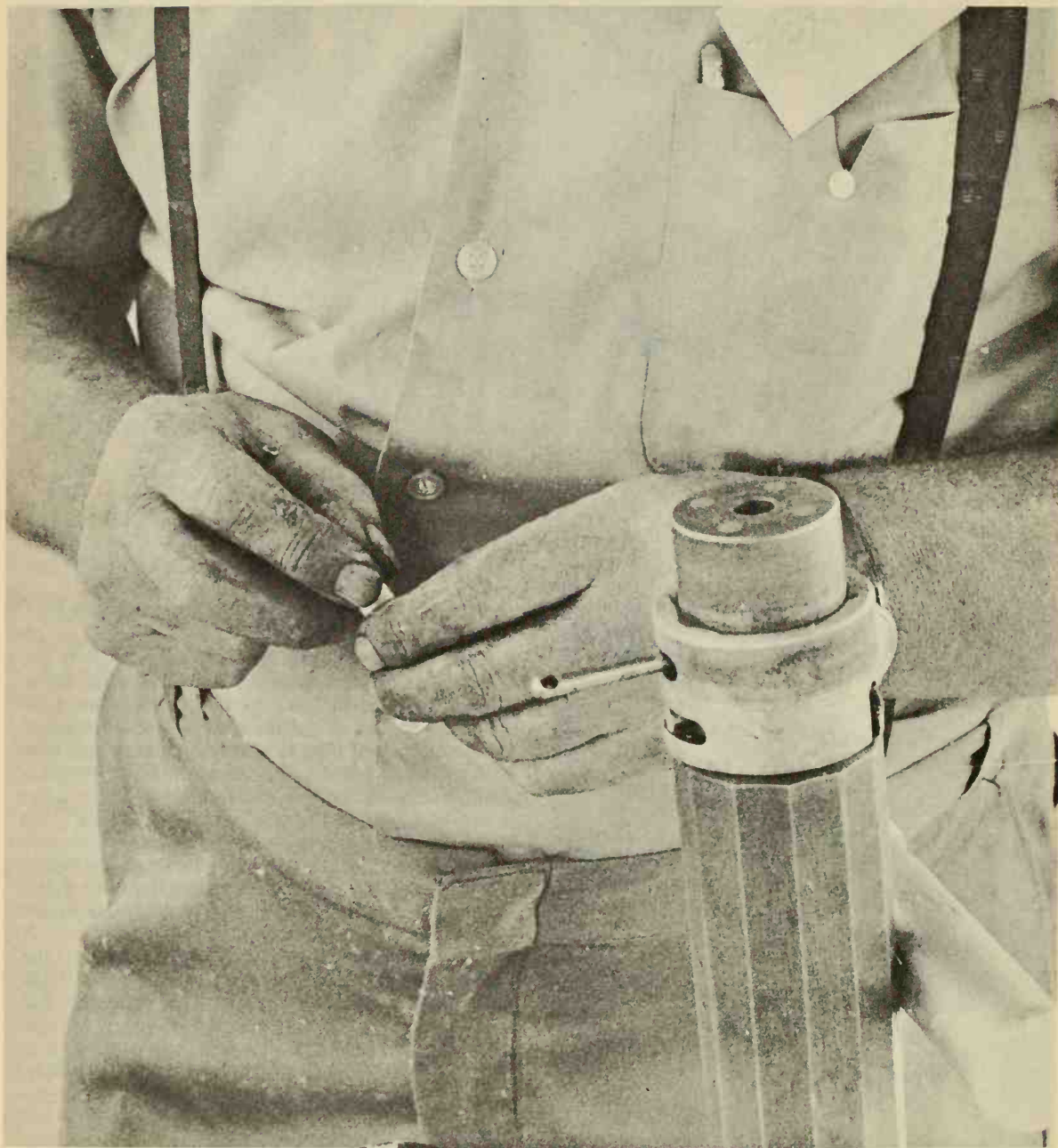


This Mountain Man is off and running on the Seneca match. In a few yards he'll come upon a partially-hidden target which must first be identified, then hit with his Long Rifle. Five such targets and a 300-yard run constitute the match. It ain't easy.

all, brother! The lady spectators cover their ears and the men listen sharply to see what new cusswords they can pick up.

The Slug Gun Matches are carried on at ranges out to 500 yards. The guns used weigh up' to 60 pounds, shoot as much as 1-1/2 ounces of lead, and are marvels of mechanical precision. To watch a top shooter is fascinating. The cavernous bore is first carefully cleaned, and then a fresh cap or primer is placed on the nipple and fired to clear the innards. The bore is wiped again and the false muzzle is carefully fitted. After loading the powder, the shooter may then select a cast bullet, forge it with a hammer on a steel plate, and drop it into a swage which is further struck with precise, controlled hammer blows to shape the bullet. The bullet is then carefully centered on oiled paper strip patches in the false muzzle, started, and seated carefully on the powder charge.

The big gun is then placed back in its rest and capped and the shooter carefully prepares to fire the shot. After reading mirage and checking wind and light, he'll touch off and a thumb-size slug will arc leisurely downrange to — he hopes — strike right in the group he's got going. All of this, cleaning, loading, and shooting, may take nearly five minutes and the shooter is busy all the time. If you watch him for several shots, you'll see that every action is duplicated as carefully as possible from shot to shot; absolute uniformity is what the slug gun requires, and what the shooter strives to achieve. And, the accuracy that can be produced with a 45-minute long, 10-shot group will amaze you.



Slug gun shooters are most meticulous in every step of loading. Shooter here is placing bullet and patch in a holder from which it will be pushed into the false muzzle and on into the barrel.



At the matches, most scattergun shooters simply lay out all the necessities in large, open containers — rather than use flask, capper, and shot and wad bags or pouches. An excellent reason for the No Smoking rule at the covered loading bench.

A slouch-hatted, bewhiskered figure sitting or squatting behind a heavy rifle rested over a pair of crossed sticks stuck in the ground conjures up visions of a squinting, odoriferous hide hunter leveling down on a herd of buffalo out on the Kansas prairie. And, that's just what it is meant to do.

This is the "Buffalo" match. The guns allowed are comparable to those once used for taking the big American Bison. The shooting position is prescribed to resemble the buffalo hunter's "stand" from which he might kill dozens of animals without ever moving. He needed the steadiest position possible, yet the waving buffalo grass was too high for him to shoot prone. So he shot sitting, kneeling, or squatting, resting the long, heavy, octagon rifle barrel across a pair of sticks. The barrel lay in the "V" of the crossed sticks and elevation could be varied by shifting the crossing point.

Even the targets are buffalo silhouettes, with the aiming point right over the lungs where the old timers usually shot.

Many other matches take place at Friendship and there are events and classes for the ladies and youngsters as well.

As appealing to many as the shooting at Friendship is the vast "Commercial Row" where virtually every item even remotely associated with black powder shooting is on display. Want a quart of genuine bear's oil for patch lubricant? Someone there will have it. Need a new barrel or a new lock for your favorite smokepole? How about an authentic trade tomahawk, a peace pipe or a bag of Indian "Kinnikinnick" tobacco? A new hunting shirt of finest fringed buckskin, and a pair of knee-high beaded moccasins?

It's all there — all you can think of and more — and it's all for swappin' or sellin'. Some suppliers spend several thousand dollars just to display (and sell, of course) their wares at The Nationals.

The people, the guns, the shooting, and all the rest combine to form an experience no muzzle-loading fan can afford to miss.

One of the most appealing facets of the muzzle-loading hobby is the opportunity (Reason? Excuse?) it gives one for getting completely away from people and things — mainly the flurry and press of what so many people call "civilization."

The competent muzzle-loading buff who has proven his ability as a marksman, hunter, an improviser, and in his ability to make do and get along may eventually find himself invited to a "Rendezvous." No, Charlie, it's not what you think. The word "rendezvous" means one thing to those of amorous bent; something else again to the bearers of the Long Rifle.

In the days of the fur trade, factors and traders held Spring Rendezvous for the trappers. Virtually overnight, a tent city, complete with saloons, stores, brothels, and all the other essential elements would spring up hundreds of miles into the wilderness. The

word would have gone out, and the mountain men and trappers would converge on the rendezvous from all directions, laden with beaver to trade. Not the least of the rendezvous purposes was to provide the itinerant riflemen with the requisite whiskey and women for a monumental carouse which often ended only when his year's earnings were gone or he'd collected a knife or bullet in his ribs. They were hard men, and with only one fling a year available, they went at it full tilt, night and day. Many a buckskinned Lochinvar survived a year in the hostile wilderness only to pass from this vale of tears in a fog of Taos Lightning and flashing Green River steel at Rendezvous.

But, the modern long rifleman's rendezvous isn't to catch up with civilization, but to get away from it. Not to carouse, but to relax. Not to die, but to live again.

Perhaps at one of the club shoots or at a big match you'll hear snatches of conversation from a group of three or four slouch-hatted, moccasined or booted figures under a shade tree.

"Early September good enough for you?"

"Good enough. Early enough to be comfortable, late enough to be no people around."

"Meet at the spring above Cooper's Bend. Primitive. One blanket, one horn of powder, salt, tobacco, little pemmican or jerky. Regular outfit otherwise."

"Fair. Walk in. All oughta be in by sundown the 5th. First one in clean the spring and shoot some supper meat. The rest get camp goin' as they come in."

"Done all around."

And they shake, and it's settled. What's settled? A fall rendezvous for three or four shooters who once or twice a year break clean with the business world and retrogress 200 years to spend a few days, or a week or two, living by their guns, knives, and wits in some isolated patch of forest. They'll walk in several miles, singly or together, carrying on their backs the bare minimum of supplies and equipment for survival — and a long, small bore muzzle-loading rifle. Game and fish taken with primitive gear will constitute their entire diet. As a base camp, they'll have a fire and, maybe, a brush lean-to in case of bad weather. They'll sleep on the ground. If the weather turns bad or hunting is poor, they'll go hungry. They may be wet and cold.

But, no matter what happens, they'll be living as did the trappers and scouts of the late 18th and early 19th Century. For a time, they'll have cast the yoke of today aside — everything except their forest camp and the daily tasks of caring for themselves will have been wiped from their minds.

They may come back gaunt, unshaven, and smelling a bit rank, but they'll have gotten a fresh jump on the rest of the world, and it had better look out!

That's a Rendezvous. When you're good enough shot with a pea rifle, and handy enough with a snare and baited hook to feed yourself in the woods; and, when you're woodsman enough to live in the woods off only the gear in your possible sack — then, and only then, you might get invited.

Less strenuous and of shorter duration are the "Squirrel Hunts" and "Woods Walks" often organized for small groups. They, too, are carried out with authentic equipment and dress. Participants expect to feed off game they kill and may be out two or three days. A woods walk may stretch for 30 miles or more and have certain tasks that must be performed at various stations along the way. And, they must be performed with primitive equipment.

A squirrel hunt may be just that — a dawn meeting in some hickory grove, followed by a day's hunting with flint or percussion squirrel rifles fittingly ended around a campfire graced by squirrel carcasses cooking on greenwood sticks. Or, it may be an extended affair approaching a rendezvous.

Hunting of all sorts plays a big part in today's use of muzzle-loading guns. Interest has grown to the point where several states have established special "Primitive Weapon" seasons for deer and similar game. A special season is set aside so that the primitive hunter won't have to compete with a horde of modern hunters equipped with scope-sighted, long-range rifles and the urge to shoot at anything that moves.

Range shooting is fine, and a lot of fun, and it makes all better marksmen. The battered hat and the carefully smoked and fringed buckskins make us look pretty woody, especially if we don't shave for a few days.

But, woods knowledge and marksmanship is put to the supreme test only when you're all alone in a hill-side thicket and a cedar-tree buck works his way up the draw toward you. Can he see you? Can he wind you? Can you pick the right time and place, and can you kill him cleanly with the single ball in your front loader? The answers come quick and positive, then. If they're all right, then you can take pride in being able to dredge forth again the latent skills that made those loose-walking mountain men able to conquer most of a continent.

Today, we compete with our muzzle loaders for acclaim or, maybe, a side bet or two. And, if we don't like the gamble, we can walk away. The rifleman of yesteryear placed the biggest stake of all on his skill with the long rifle — his life. And, he couldn't walk away if he didn't like the odds.

As we've mentioned earlier, way back in Chapter 2, muzzle-loading shooting has been going on all along — or, rather, we should say that it never stopped. In some parts of the country, notably the hilly south, percussion rifles never went out of fashion insofar as shooting for pure enjoyment is concerned. Men nurtured on the

caplock bought lever-action cartridge repeaters for mundane purposes like killing meat and convincing revenooers to stay up north. But, for proving their skill in shooting the mark, they never forsook those fine, long-barreled caplock rifles. Many of them have now been in the same families for well over a century and may have been freshed out two or three times.

Those guns were still in use in the hills of Ohio, Kentucky, Indiana, and points south back in the early 1930's. Just casual use to please the owners, for there was no association or organization to tie shooters together and to set up competitions. Shooting was in the traditional manner when a few black powder fanciers gathered for a day on afternoon or for a more formal fall "Beef Shoot."

Slim Ackerman (whom everyone in this game should know from his profuse writings) tells me that in February of 1931 a muzzle-loading match took place in Portsmouth, Ohio. It came about as a result of some earlier joshing E.M. "Red" Farris and a shooting buddy had taken by a black powder booster. The muzzle-loading clan had been invited to come on up and show their prowess. Show, they did, from the hills of Ohio and Kentucky.

The match turned out so well that several people decided they'd like to try the muzzle loaders. Things looked promising, so the match was repeated the following year. New people and, undoubtedly, new guns showed up, and scores were higher. Interest was such that it seemed advisable to form an organization to promote, schedule, and regulate matches and competition in general.

The upshot of all this was the formation of the National Muzzle Loading Rifle Association, with the genial Farris elected Secretary and, as Slim put it, general factotum. The founding group also included Oscar Seth, who'd been a party to setting up that first match, Walter Cline, Bull Ramsey, Walter Grote, Boss Johnston, Clarence McNeer and a goodly number of others. All had learned to love and appreciate the muzzle-loading rifle and recognized the common bond it already formed among a good many men.

An association bulletin was organized and circulated, soon to be replaced by "MUZZLE BLASTS," which remains today the official organ of the association. All members receive it today and those who have had the foresight to save and have it bound over the years now own a most valuable source of reference material on muzzle loading in all its forms. "Muzzle Blasts" has been put together for several years now by Maxine Moss, a delightful and dedicated lady who seems to eat, sleep, and drink the job.

Eventually the association purchased an attractive, rolling, partly timbered tract of land just north of the village of Friendship, Indiana. The goal was a permanent range and association home. The result was a good one — it's a quiet area (except when a big

match is in progress) and one can walk 5 minutes into the woods with long rifle in hand and feel he's left a lot of today's world behind.

The range was built — not much at first, but it grew and grew. It was named "The Walter Cline Range" after one of the founders and early association presidents. It lies alongside Laughery Creek and today rings to the crack of many a squirrel rifle all season long. And don't be surprised any day to see a figure there looking like a Sublette man just in with beaver to trade. Full period dress doesn't get you labeled "eccentric" there.

Additional land purchases have expanded the area considerably and the ranges of today are well laid out, comfortable, and roofed to provide protection from the elements. Matches are held frequently during good weather, but the highlight of the season is "The Nationals" already mentioned. Particularly impressive is the massive clubhouse with its stone fireplace and beamed ceilings where one and all can gather for bragging or explaining, whichever scores dictate.

In the meantime, the association has functioned well. In addition to providing national championships, a permanent home for muzzle loading, and a most useful journal, it has promoted and fostered shooting throughout the country. There are well over 150 charted muzzle-loading clubs in the U.S.A., all affiliated with the association and subscribing to its codes, goals, and ideals.

In accomplishing all, this the association has had to establish rules and regulations, though it appears they have been held to the minimum consistent with reasonable control — something that can't be said for some organizations I know.

As a result, competitive shooting is now based on classification. There are matches for tyros, youngsters, ladies, septegenarians, revolver, pistol, shotgun, slug guns, round ball rifles, and any reasonable other classification one might desire. Rules have been kept down to the minimum consistent with insuring everyone a fair chance at winning. Gun types are outlined loosely and so far this has worked well, without the bickering over minor points one occasionally encounters among shooters of more modern weapons.

Through all this development, I'm certain Red Faris had a lot to do with keeping things practical and in preventing hide-bound specialist's groups from crowding fun shooters out. He's that kind of man. Still quite active in and for the association after 35 years, he is the only survivor of the original founders. A considerable debt is owed him by all who enjoy muzzle-loading shooting today.

For the benefit of those who may want to make certain new guns and equipment will be adaptable to the competition at Friendship, we reproduce here excerpts from the latest (7th edition) of the NMLRA Range Rules. These rules and regulations apply in all competitions sanctioned by the association.

H. EQUIPMENT (RIFLES)

- H-1-Metallic Sights—Any sight, including tube sights, not containing a lens or system of lenses, except a single lens may be attached to the rear sight as a substitute for prescription glasses.
- H-2-Any Sights—Any sights without restriction as to material or construction, excluding scopes.
- H-3-Open Sights—Rear open sight is one where the opening is a U, V, or rectangular opening as wide at the top as at any part of the sight. Front sight may be a blade, pin-head, post or barleycorn, shaded or unshaded.
- H-4-Telescopic Sights—Any sight or combination of sights containing lenses for the purpose of magnification.
- H-5-Spotting Scopes—The use of a telescope to spot is permitted in all events.
- H-6-Powder—It is an irrevocable rule that the propellant charge used in our muzzle-loading matches will be of BLACK POWDER AND BLACK POWDER ONLY.
- H-7-Ignition—Ignition only by old type percussion cap that fits on nipple or flint stone striking frizzen.
NOTE TWO EXCEPTIONS:
(1) Wheellock with original type of ignition.
(2) Slug Guns may use primers.
- H-8-Flint-Locks—Safety shields must be used on all Flint Lock bench rifles.
- H-9-Muzzle Loading Gun—Any gun in which a Black Powder and patched ball or patched bullet is loaded in the muzzle of the rifle and ignition at the breech is by cap or flint. Exception—Revolver and Musket.
- H-10-Musket as Issued—A musket as issued by States, National Government or Confederacy. Caliber .54 .58 or .69 only. Replicas permitted as approved by N-SSA.
- H-11-Shooting Jackets may be used in any Muzzle Loading Match up to and including a 10-X Large or Small Bore Jacket; standard weight will be allowed. No International type jackets allowed.
- H-12-Gloves—See Q-1.

I. TYPES OF COMPETITION

- I-1-Individual Match—An event in which the competitor reports to the Range Officer.
- I-2-Re-Entry Match—An event in which the competitor is permitted to fire more than one score for record; one or more of the highest scores being considered to determine the relative rank of competitors. The number of scores which may be so fired, and the number of high scores to be considered in deciding the relative rank of competitors must be specified in the program.

J. POSITIONS

J-1-Offhand Position—This means extended arm supporting the rifle, no part of the supporting arm to touch the body; elbow to be at least six inches from the body. The rifle must rest in the palm of the hand and not on the fingertips except in Scheutzen Matches, where the palm or hip rest may be used or otherwise indicated on the match program.

J-2-Prone Position—In all prone matches, bench rests may be used when furnished by the shooter. In all prone matches when fired either in prone position or from a bench rest, no part of the rifle shall touch the ground or bench except that part which is supported by the muzzle rest. The butt of the rifle must be supported by some part of the body.

For the 1968 season, the following targets are to be used per the NMLRA Rules & Regulations. However, target changes are under consideration.

K. TARGETS

K-1—6 Bull or 50 Yard Target Dimensions. 1 Sighting and 5 record bulls on tagboard or paper.

X ring — .39 in.	7 ring — 3.89 in.
10 ring — .89 in.	6 ring — 4.89 in.
9 ring — 1.89 in.	5 ring — 5.89 in.
8 ring — 2.89 in.	

K-2—Single Bull or 100 Yard Target Dimension.

1 sighting and 1 record bull on tagboard or paper in 5 shot events.

1 sighting and 2 record bulls on tagboard or paper in 10 shot events.

X ring — 1 in.	7 ring — 8 in.
10 ring — 2 in.	6 ring — 10 in.
9 ring — 4 in.	5 ring — 12 in.

K-3—200 Yard Target Dimensions.

1 sighting and 1 record bull on tagboard or paper in 5 shot event, 2 record bulls in 10 shot event.

X ring — 2 in.	8 ring — 12 in.
10 ring — 4 in.	7 ring — 16 in.
9 ring — 8 in.	6 ring — 20 in.

K-4—300 Yard Target Dimensions.

The standard 200 Yard target is used on the 300 yard range.

K-5—Special and novelty targets shall be governed by the match in which they are used.

N. TYPES OF COMPETITION

N-1—Muzzle-loading Pistol and Revolver Match—Any match usually fired at ranges of twenty-five feet and over, indoors and out of doors using one of those classes of arms:

- (a) Any muzzle-loading revolver or multi-shot pistol using round ball or bullet and fired by percussion cap.

- (b) Any single shot muzzle-loading pistol using round ball or bullet and fired by percussion cap.

- (c) Any muzzle-loading flintlock pistol using round ball or bullet.

The sights on these arms must be entirely open and uncovered.

N-2-Re-Entry Match—An event in which the competitor is permitted to fire more than one score for record; one or more of the highest scores being considered to determine the relative rank of competitors. The number of scores which may be so fired, and the number of high scores to be considered in deciding the relative rank of competitors must be specified on the program.

O. TARGETS

O-1-Official Targets—In pistol matches, only targets approved by the National Muzzle Loading Rifle Association will be used.

O-2—50 Foot Rapid or Time fire Target (used for slow fire at 50 ft.)

(9 and 10 rings blacked to form aiming bull.)

10 ring — 1.80 in.	7 ring — 6.14 in.
9 ring — 3.06 in.	6 ring — 8.32 in.
8 ring — 4.46 in.	

O-3—25 Yard Rapid or Timed Fire Target. (used for 25 yard slow fire) (9 and 10 rings blacked to form aiming bull.)

10 ring — 2.24 in.	7 ring — 7.46 in.
9 ring — 3.76 in.	6 ring — 10.08 in.
8 ring — 5.44 in.	

O-4—50 Yard Slow Fire Standard American Target (8, 9 and 10 rings blacked to form aiming bull.)

10 ring — 3.39 in.	7 ring — 11.00 in.
9 ring — 5.54 in.	6 ring — 14.80 in.
8 ring — 8.00 in.	5 ring — 19.68 in.

O-5—25 Yard Rapid or Timed Fire Target. (Also used for 25 yard slow fire)

Exactly the same target as the 50 yard slow fire Standard American, except that only the 9 and 10 rings are blacked to form aiming bull.

Q. ACCESSORIES

Q-1—Gloves—Gloves may not be worn which in any way form an artificial support.

Q-2-Spotting Scopes—The use of a telescope to spot shots is permitted competitors in all events. No part of the telescope or telescope stand may touch any part of the competitor's clothing or person.

Q-3-Shooting Kits—Shooting kits may be taken to the firing point when they are of such size and construction as to not interfere with shooters on the adjacent firing points.



Chapter 17

EARLY BLACK POWDER BREECH LOADERS AND CARTRIDGE GUNS

Man was more or less satisfied with muzzle loaders for the several centuries the flintlock reigned, but with the coming of the percussion cap, it became evident he just *might* be able to produce reliable breech loaders. The "patent" percussion cap-ignited designs of before the Civil War aren't very common today. However, large purchases of Sharps, Burnside, etc., during that war make the later designs plentiful enough today that lots of people would like to shoot them.

Generally speaking, these guns fall into two loading systems. In the first type, the rear of the barrel is uncovered by movement of either barrel or breech mechanism to allow some form of cartridge to be inserted into the barrel; the second type has a hinged breech section which raises or lowers at its front to be muzzle loaded with some form of cartridge, and then dropped back into alignment with the bore for firing. The Sharps is an excellent example of the first type, the Burnside of the second. Both types were intended to be loaded with loose powder and ball at the breech if the cartridge supply gave out, and could also be muzzle loaded if the breech mechanism failed to open. All of the designs we'll mention here used the standard percussion cap on a nipple for ignition — the "cartridges" containing only powder and bullet and being provided with direct communication from nipple to powder for the cap flash.

Nearly all of these "Separate Ignition" guns can be fired today if one exercises a bit of ingenuity. We'll go down the list in order of the quantities produced and describe how they can be loaded and shot today *without being altered*. All are primarily U. S. military arms, but civilian models will be encountered occasionally.

Sharps: The vertically sliding breech block is lowered by a lever, exposing the rear of the chamber. A *combustible* (nitrated) linen cartridge containing bullet and powder is inserted. Raising the lever lifts the breech block whose sharp upper edge shears off the rear of the linen cartridge, exposing the powder charge to flame from a percussion cap. The cap flash travels through a hole in the breech block into the powder.

Reproductions of the original cartridges are easily made from nitrated paper or linen as shown at the end of this chapter. In addition, if the gun breech is tight and not eroded, the breech block may be left closed and the gun loaded from the muzzle in the usual fashion. It may also be loaded by simply dropping a bullet into the chamber from the rear, and then pouring the chamber full of powder before closing the breech.

With any of the above methods, the Sharps has a habit of leaking at the breech. If parts are rusted or eroded badly, gas escapes in sufficient quantity to be dangerous to the shooter. In addition, loose powder gathers in the breech and is sometimes ignited by the cap flash, creating a secondary explosion there.

Burnside: The chamber section of this gun tips up at its forward end to accept a tapered brass cartridge inserted rearward. The breech is closed, and the cap flash reaches the powder charge through a hole in the rear of the case.

Lacking cartridges, the breech may be opened and a charge of powder poured into the chamber. This is followed by a bullet seated below the chamber mouth, the breech is closed and the piece fired. By leaving the breech closed, loading may be accomplished from the muzzle in the usual fashion. Since there is some gas leakage at chamber/barrel junction, a gas check is sold today to eliminate same when loading from the muzzle. This is a steel ring placed in the chamber mouth. The force of the first firing wedges it forward to bridge the barrel/chamber gap. When firing is concluded, the ring is knocked back into the chamber with a rod so the breech may be opened for cleaning.

Best of all for the Burnside's are the polyethylene plastic cases currently sold. They approximate the original brass case and may be re-used many times.

Smith: The Smith breaks open somewhat like a shotgun and a *rubber* or paper and brass cartridge is inserted directly into the chamber. The rubber case can be duplicated by turning its likeness from Teflon rod, and then loading with powder and bullet. If you'd rather have brass, cases can be made from brass tube with a pierced plug soldered in the base. A flash hole in the

center of the case head admits the percussion cap flash. This gun may be muzzle loaded if some form of obturating gas check case is used.

Maynard: This is a tipping-barrel design using an unprimed, but otherwise fairly conventional rimmed brass cartridge case. A hole in the center of the case head admits the cap flash to the powder charge.

The cartridge case is essential to firing this design for there is no other provision for sealing gas in the chamber. With a proper case, it may be loaded from the muzzle, or the case may be loaded with powder and bullet and used conventionally.

Dixie Gun Works supplies a short, turned steel case which seals the chamber and allows muzzle loading *only*. A few small shops make up full length brass cases for regular use. Typical methods of making Maynard cases are shown at the end of this chapter. No competent gunsmith or machinist will have any trouble making such cases. Since they virtually last forever, 10 or 12 cases will keep a Maynard shooting for a long time and their cost of a dollar or two each won't seem excessive at all.

Hall: The first standard U. S. breech loader and first made as a flintlock. It uses a separate chamber piece which pivots upward exposing the chamber mouth. It was originally intended for use with the standard paper musket cartridge. Bite off the end of the paper, pour in the powder, seat ball and rest of paper on powder, then close breech and fire. It was also meant to be loaded with loose powder and ball in the same manner as well as from the muzzle if the breech became inoperative for any reason.

The best you can do with this one is to load it just the way the designer intended (above). Since considerable gas escapes at the breech/barrel junction, one could fit a sliding gas check there. One similar to that described for the Burnside would certainly make shooting more pleasant, though it would restrict the gun to muzzle loading while in place.

Many other offbeat designs were manufactured during the Civil War and may occasionally be encountered. Some were chambered for conventional *primed* rimfire or centerfire cartridges, and we'll talk about them later. Those depending upon percussion cap and nipple ignition don't really present too many problems. A close examination of the breech mechanism will usually suggest a manner in which a short, thin-walled brass or copper gas check can be fitted to allow safe shooting by muzzle loading, at least.

In some instances, a cartridge case similar to the Maynard can be made up and used conventionally. When this is done, care should be taken to see that the case fits the chamber snugly and that the rim fills the space intended. Some of those early cartridges were quite odd by today's standards. In making or having such cases made, it's best to work from a full chamber cast and carefully-taken dimensions.

While some of those old guns may look rather hopeless, there are darn few of them that can't at least be shot safely by muzzle loading. It just takes a bit of thought and effort.

We can't work our way through a whole book about black powder arms without mentioning those many fine old metallic cartridge breech loaders that came before the smokeless era. The Golden Age of small arms development was spurred by, and began with, the American Civil War. Reliable, convenient, accurate, and powerful breech loaders of all the types we know today were developed during the tail-end of black powder's seven-century reign.

The repeating magazine rifle and shotgun were nurtured on black powder. The basic Mauser-type, bolt-action rifle, destined in the next century to slaughter millions all over the globe, first barked with black powder. The lever, pump, and automatic rifles were all first built around black powder-loaded cartridges. That great destroyer of WWI, the machine gun, arose from man's genius, fueled with black powder. The Maxim M.G., destined to arm both sides at Ypres, the Somme, Verdun, and countless other blood-soaked arenas won its spurs and acceptance piling up windrows of dead in Africa with black powder.

So, with complete accuracy we say that virtually every type gun we have today, with the possible exception of the automatic pistol, was first developed around black powder.

Uncounted millions of those black powder arms are still in shooting condition. And, most of them seem to have wound up in this country by one means or another. They beg to be shot, and with plenty of gunpowder, lead and primers available, there's no reason for not using them.

Regardless of the caliber of the gun, it can, if in good mechanical condition, be fired with the proper bullet and all the ffg or fffg Powder the case will hold to the base of the seated bullet. Cases of those bygone days were designed to just hold the correct amount of powder, so can't be overcharged as often happens with smokeless powder.

Since factory black powder loads are no longer available in any caliber except as aged lots from dealers in obsolete ammunition, you'll have to reload. This isn't a book on reloading and I've already used too many pages to go into it here. For that part of the story, I refer you to "The Shooter's Bible Reloader's Guide," by my good friend, R. A. Steindler, published by the same gentlemen who did the honors with this book.

However, some information is in order. Reloading dies in virtually every black powder caliber can be obtained from RCBS, Inc., Box 729, Oroville, California, as can all other loading equipment. But, the boys who bought 1873 and 1886 Winchesters didn't have our modern reloading equipment, yet they got the job done. Cheap and simple sets of tools are avail-

able from Lee Custom Engineering, Inc., Hartford, Wisconsin, and Lyman Gun Sight Corp., Middlefield, Connecticut. They aren't fast, but they are durable and reliable, and they will turn out perfectly-loaded cartridges.

But, you can get by with nothing more than a bullet mold and a few scrap materials and household tools. Suppose you have an old Springfield or Remington .45-70-500 caliber rifle and a handful of empty cases.

First, wash the black powder fouling out of the cases as soon as they are fired. It will corrode and weaken the brass if not removed. Try each case in the chamber to make sure none over-expanded. Any that don't go in should be set aside for eventual full-length resizing.

Drill a 1/4" hole in a board or block of wood. Set the fired case over the hole, and with a 1/16" diameter nail or wire seated in the end of a piece of dowel, force out the fired primer. A little juggling will get the nail into the flash hole easily enough. This is simplified if the dowel just fits into the case and the nail is centered in it, providing automatic alignment as the dowel enters the case.

The case is now ready to be reprimed. Place a piece of dowel slightly longer (1/8" is enough) than the case in the case mouth and start a primer in the pocket by hand. Place this assembly squarely between the jaws of your vise with primer against one jaw, dowel against the other. Gently close the jaws to force the primer into its pocket. The primer must go in flush with the surface of the case head. A large C-clamp can also be used for the same purpose.

If you've an adjustable powder measure handy, set it to throw a charge of fg or ffg that will come fully up to the base of the bullet when it is seated. Lacking a measure, don't fret, just pour in powder to fill the case to that point. If you've many rounds to load, cut a reject case off to just hold the right powder charge. Then use it as you would a charge cup for muzzle loading. A card or felt wad seated firmly on the powder makes handling more convenient while seating bullets, but isn't otherwise necessary.

Cast your bullets as outlined in Chapter 10, and when cool, smear the grease grooves full of your favorite lubricant. Don't use too much and please keep the bases clean. Start a bullet by hand in a charged case. If the mouth seems pinched in and stops the bullet, flare it out a bit with any hard, conical object, even an old plumber's countersink rotated backward. Don't flare the mouth too much or it won't enter the chamber freely.

With bullet started straight, again place the cartridge-to-be in the vise and slowly close the jaws to press the bullet down on the powder.

A block of wood taped to one vise jaw as a stop will insure reasonably uniform seating depth. If the bullet starts to lean, back off on the vise a bit and

rotate the cartridge 1/2 turn. This will usually straighten out the bullet, but if it doesn't, do the job with your fingers.

Wipe any excess grease from the completed assembly, and you've got a loaded cartridge ready to fire.

Cartridges loaded in this fashion will do fine in single-shot rifles, or when loaded directly into the chamber of repeating arms. In order to be used through tubular or box magazines, the case must be crimped on the bullet. Unless this is done, recoil will cause bullets to move in or out of the case mouth, resulting in failures to feed from the magazine. A bullet seat-crimp die is required for this, as a tool or press in which to use it.

Eventually your cases will expand to the point they either won't enter the chamber or won't grip a bullet. To correct the former, they'll have to be resized and this means a resizing die. The old-style Lyman-Ideal type into which the case is driven or pressed is simplest and cheapest and entirely adequate for this type of loading. To tighten the case on the bullet the same operation must be performed but to a lesser degree. Use the same die, but run the case in only far enough to squeeze the mouth down enough to hold the bullet.

A handful of cases and the simple tools just outlined will enable you to keep any centerfire black powder breech loader talking for years to come. Of course, we chose only the .45-70 as an example. Exactly the same procedures and tools apply to any other caliber you might come up with from the .32-20 Winchester to the big .50-3-1/4" Sharps.

Often the old timer will be encountered in a caliber for which it is very difficult to obtain even a few good cartridge cases. When that happens, look up the caliber in my book "Cartridge Conversions." There you'll most likely find detailed instructions for making what you need from cases that are readily available by what we call "reforming."

Even after the fine breech-loading single-shot target rifles of the 1880's and '90's came along, many a die-hard muzzle-loading fan was hard to convince. Even though the "cartridge guns" had proven themselves superior for hunting and war (which to the true rifleman is somewhat akin to hunting), accuracy purists were by no means ready to drop muzzle loading as a concept. To be sure, they liked the convenience of the brass cartridge case and easily operated breech, free of the bothersome details of loose caps, powder flasks, etc. But to them, it just didn't seem likely that the bullet could be started from a new-fangled cartridge, squeezed down to fit the rifling, and still strike as close to dead center as the carefully front-loaded slug or ball.

They must have been right, at least during the transition period. In "The Breech-Loading Single-Shot Match Rifle," the late Ned Roberts says, "Even as late as 1886, the best breech-loading match rifles in the hands of expert marksmen were not capable of making

as high scores or small groups at 220 yards rest shooting, as those made with a muzzle-loading caplock rifle.” He goes on to cite examples to prove the point, though, Ken Waters points out that in at least one of the examples the muzzle loaders used the best available telescope sights and shot from machine rest, while the breech loaders used iron sights and were shot from muzzle rest only. In correspondence with Roberts, A. O. Niedner stated that the better shooters in his area all used muzzle loaders until around 1895. Even so, U. S. shooters beat the Irish and British teams at long-range shooting. The foreigners used muzzle-loading rifles, the Americans breech loaders.

The end result of all this was that certain discerning gentlemen combined the two systems into what became known as “Breech-Muzzle-Loading.” The breech-loading rifle was used, along with a *bulletless* cartridge case containing the powder charge, held in place by a thin wad. The bullet proper was loaded from the muzzle through a carefully-fitted false muzzle in classic fashion.

Many top shooters swore that only in this fashion could maximum accuracy be developed. They attributed the fine accuracy of muzzle-loading caplock rifles in part to the fact that no “fins” were produced on the bullet base. A bullet being driven forward into the rifling will have a certain, though small, amount of metal displaced rearward as the lands cut into it. This displacement results in fins or tails of metal being dragged rearward of the base. Additional fins will be formed if the bullet is larger in diameter than the bore. On the other hand, a muzzle-loaded bullet is swaged down and cut by the lands toward its point, leaving the base free of distortion. Gentlemen such as Dr. Mann and Harry Pope eventually proved to the satisfaction of themselves and many other shooters that breech-muzzle-loading kept bullet bases perfect and was worth the effort required, in terms of superior accuracy.

While some breech-muzzle-loading was done with paper patched bullets, the blunt, cylindro-conoidal form with several annular grease grooves emerged as the best, or at least, the most popular. They were carefully cast to proper diameter, and then the grease grooves were filled by means of a lubricating pump without distorting the bullet in any way.

These lubricated lead bullets were then loaded through a false muzzle nearly identical to those used on caplock target rifles. Of course, the patch guides were not needed. To ease the human effort required to start the bullet, toggle-joint starters with considerable mechanical advantage were often used. The bullet was then seated to a predetermined point just ahead of the chamber, by means of a stiff “loading rod.”

After all this, the primed powder-filled case was chambered, the breech closed, and the gun was ready to shoot.

As with caplock target rifles, much depended upon the degree of perfection with which the bullet was

made and seated. Special molds were often used, the Pope “nose-pour” type being deemed among, if not actually the very best. Perfection of base was sought by pouring and cutting off from the nose. Bullets were cast in two forms: tapered (stepped), with front bands bore diameter and at least the base band groove diameter or slightly larger; straight, with all bands of bore diameter. Both had their staunch supporters, and both won matches.

Such guns were known to be highly temperamental, especially in regard to bullet lubricant and bullet hardness. Some shooters varied bullet lubricant hardness according to the seasons, having found that what produced best accuracy in hot weather was not adequate in cold — and vice versa. Bullet “temper,” as it was called, might vary from one part tin to forty parts lead, to as much as one part tin to twenty parts lead. Only extensive experimental shooting could tell the shooter what combination was best for a particular rifle. Two apparently identical rifles might have vastly different preferences.

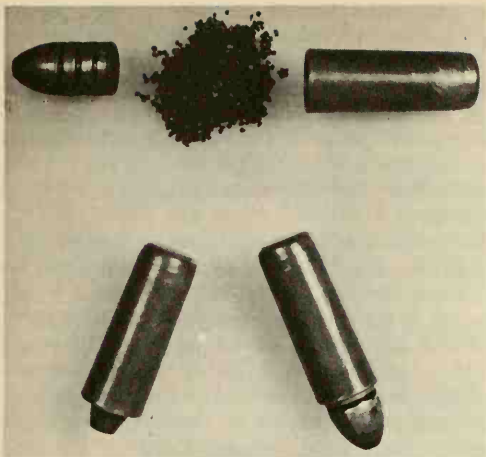
As with the caplock muzzle loader, absolute uniformity of components and loading procedures were (and are) essential to match-winning accuracy.

In this manner, muzzle loading lived on as a concept essential to the production of maximum accuracy, long after it was obsoleted from a practical standpoint by advancing technology. As late as the late 1940’s, and early 1950’s, it was still believed by many that the modern breech loading rifle fired with self-contained cartridges loaded with metal jacketed bullets would never surpass the accuracy of the breech-muzzle-loading target rifle. Modern bench-rest shooters have since proven otherwise, but it took them quite a while to do so.

As a matter of interest, one can use this breech-muzzle-loading system just for fun. There are thousands upon thousands of obsolete large-caliber black powder single-shot rifles around the country. Most common are the Springfield Trapdoor models and the Remington Rolling Blocks. Simply load a patched ball or lubricated bullet from the muzzle using a ramrod stop to insure the bullet stops at the proper point in the barrel. Then, chamber a primed and powdered case, and you’re ready to shoot. Not very authentic, perhaps, but lots of fun. The Remington also lends itself well to conversion to a true caplock muzzle loader, as outlined elsewhere in this volume.

Cartridges for muzzle-loading arms are a lot older than you might think. Doubtless it isn’t possible to say exactly when they were actually used for the very first time. We do know the troops of King Gustav Adolphus used cartridges of a sort — ball and powder charge enclosed in a twisted or rolled paper envelope.

Until the coming of the semi-rigid plastic tube or vial, paper cartridges were about the only way loading from the muzzle could be speeded up. Though made in



Simple plastic tubes into which powder and bullet can be placed make muzzle loading more convenient. When time to load, just withdraw the bullet and pour the powder down the muzzle.

many different ways and from various sorts of paper, the cartridge consisted basically of a paper tube; ball in one end; powder in the other; both ends twisted, folded, or tied shut.

This type can easily be made today exactly as it was well over a century ago. Select a piece of dowel very slightly larger than the diameter of the ball or bullet to be used. Make it long enough for convenient handling and round off one end. Sand smooth, shellac or varnish, and then wax heavily. This is your cartridge stick, or form.

Wrap paper around it to determine the size sheet needed to form a cartridge tube. Old cartridges were not glued, the paper being overlapped sufficiently to prevent powder leakage, and you may cut your pattern for this type. I prefer a glued tube and for it simply allow 1/4" or 3/8" overlap. Once the pattern is made, make a template of it from cardboard or light sheet metal. Then you'll be able to stack eight or ten sheets of paper and cut that many blanks simultaneously with a razor blade or sharp knife. Don't use a hard-finish, glossy paper which will tear too easily. A fairly soft, tough paper works best.

Roll a blank around the stick and brush the overlap thinly with a quick-drying cement and press together. Slip the resulting tube down so it overhangs the rounded end of the stick. Twist the end of the tube closed and secure it with a couple turns of heavy thread tied securely. Slip the tube off the stick, set it aside to dry, and make some more. It pays to have plenty on hand.

Drop the round ball or lubricated minie bullet into the paper tube to settle in the closed end. The minie must, of course, go in point first. Slip the stick in and tap the ball to seat it solidly. With the stick still in

place, throw two turns of thread around the tube directly behind the ball and tie it off. This prevents powder from working down around the ball during handling.

Draw out the stick and drop in the proper powder charge. The remainder of the tube may be either tied off tightly or closed by folding and creasing as shown. Tying is the most secure method, but the folded tail is easier to tear off when loading.

In use, this cartridge is torn open at the base, powder is poured down the barrel and the ball and attached paper is rammed down the bore.

Some shooters dip the bullet portion of such cartridges in melted tallow, but I find this too messy and of little real value.

Modern shooters replace this type of musket cartridge with the plastic vial mentioned earlier. The powder charge is simply dumped into the vial. The bullet (minie) is then forced into the vial mouth as a stopper. In use, the shooter grabs the protruding bullet in his teeth, twists off the vial, and pours the powder down the bore. The bullet is then rammed in conventional fashion.

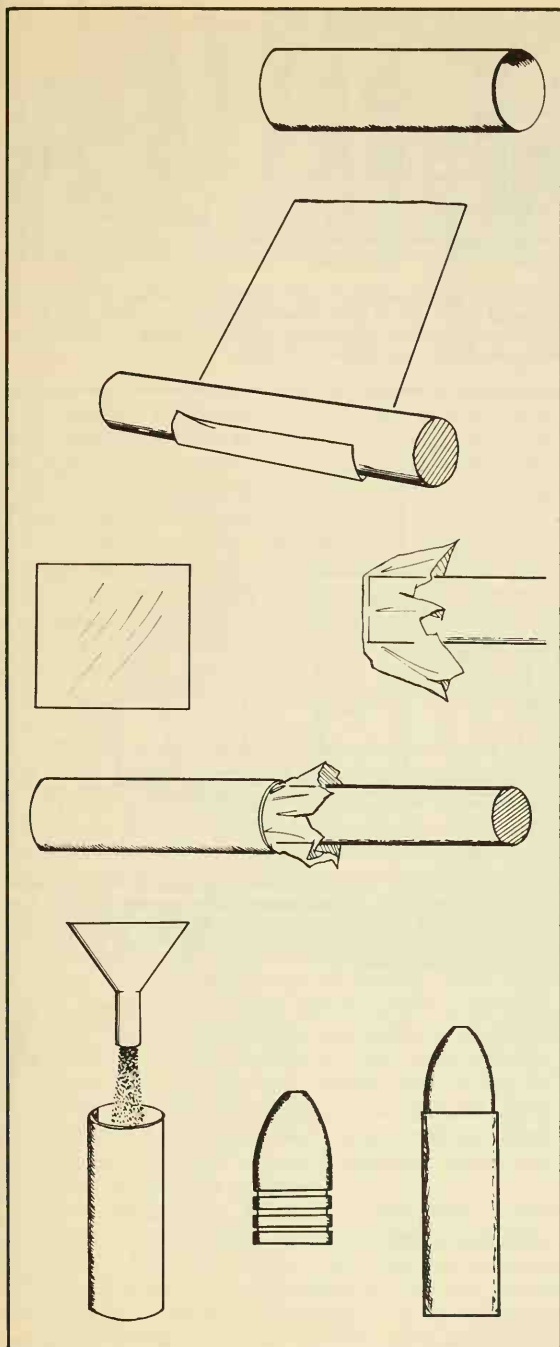
Combustible paper cartridges may be made for Sharps and similar breech-loading Civil War vintage arms. A flat-ended cartridge stick is made of a diameter that will produce a tube into which the bullet will fit snugly.

Good quality bond paper is best for this purpose. Some prefer onionskin because it is thin and light, but the cap flash will penetrate the heavier paper just as well if it is properly nitrated.

Paper is nitrated by soaking whole sheets in a saturated solution of Potassium Nitrate and hanging it up to drain and dry. This paper is then cut to a size that will roll around the stick and allow a substantial seam. Its length must be regulated so that when the assembled cartridge is fully forward in the chamber, its rear will reach the breech block, placing the powder close to the vent leading from the percussion cap. The nitrated paper will burn almost like gunpowder, leaving no significant residue in the chamber.

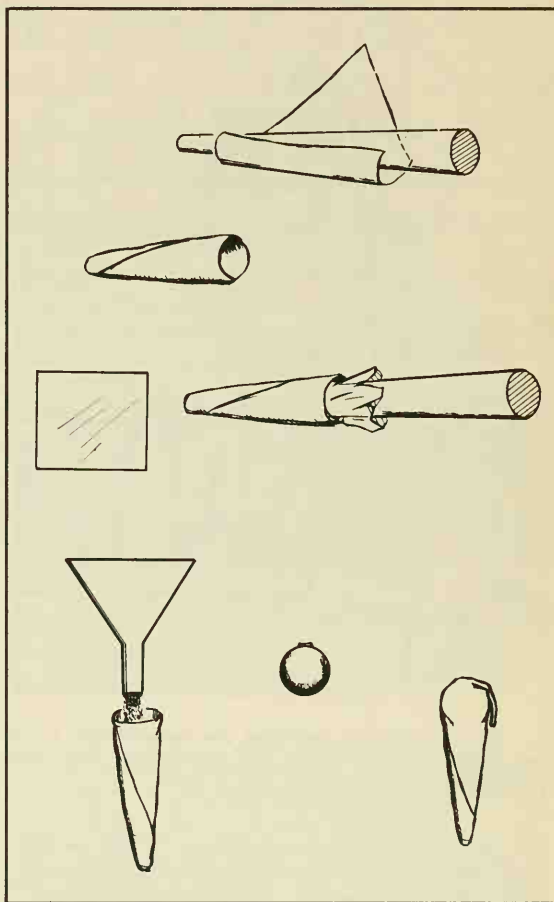
Roll the nitrated paper around the cartridge stick, glue the seam, slip the resulting tube off and let dry. Nitrate onion-skin paper and cut in squares that will fold back over the end of the cartridge stick as shown. Place on the end of the stick and press down into the cartridge tube, flush with the end. Brush a bit of cement around the edge to secure it to the tube. Very little cement is required.

Drop the powder charge in the tube. Insert the bullet into the mouth of the tube. Brush glue around the mouth to secure bullet and case together. An alternate method is to tie the tube tightly around the bullet base, or make the tube long enough that it may be tied shut over the nose of the bullet. In either case, dip the bullet portion of the completed cartridge in melted lubricant.



Cylindrical combustible paper cartridges for Sharps and similar rifles are easily made as shown. After nitrating, roll paper into a tube that will enter the chamber; plug one end with a piece of tissue paper; charge with powder; seat bullet; and glue or tie case to bullet.

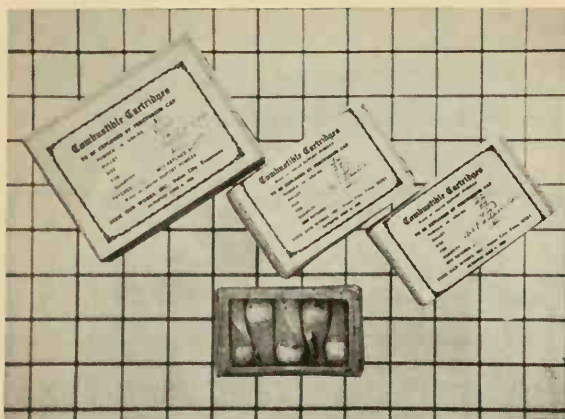
Combustible cartridges for revolvers are made in exactly the manner just described except that a tapered forming stick is used with wedge-shaped blanks. Revolver cartridges must be tapered to the rear for easy insertion into the chambers. The drawings show this in detail.



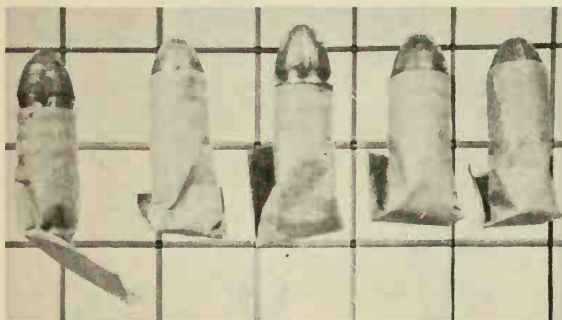
Tapered combustible paper cartridges are no more difficult to make than the straight kind. For revolvers they are essential, but for that use, the case need not be brought forward completely over the bullet as shown.

Incidentally, I once met a fellow who made up this sort of tapered combustible cartridge for use in the .58 caliber rifled musket. It seemed to work well for him, and did facilitate reloading. If you'd like to try it, just make an enlarged version of the revolver cartridge using a minie bullet properly lubricated.

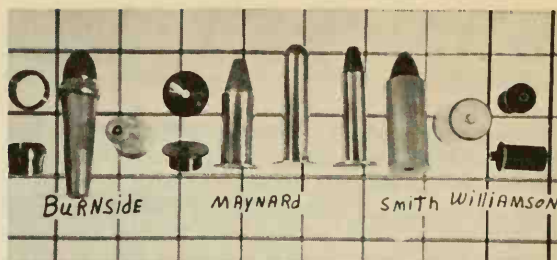
Paper cartridges are just another example of the things you can do to further enjoy muzzle-loading shooting. After a little practice, they aren't at all difficult to make.



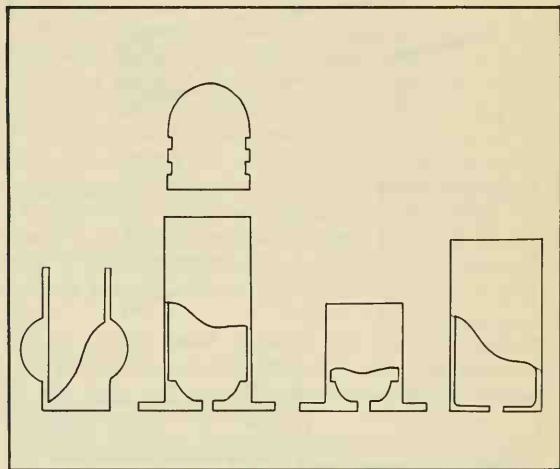
Even ready-made combustible cartridges for the various calibers of percussion revolvers are now offered for sale in the event you want to use them but can't spare the time to build them yourself. Shown here are .60, .54, and .44 caliber versions offered by Dixie Gun Works.



Plain paper musket-type cartridges are available from a few small makers. Samples shown here are available from Dixie Gun Works.



Cases and gas checks of both plastic and brass or steel are available from Dixie Gun Works for many of the Civil War era breech loaders. Illustrated here are those for Burnside, Maynard, Smith, and Williamson guns.



Cases (2nd. & 4th. from left) and gas checks for use with most of the early percussion cap-ignited breech loaders can easily be turned from brass bar stock. Sectional views shown are typical of the types required, but each should be tailored to fit the individual weapon.



CHAPTER 18

CANNON

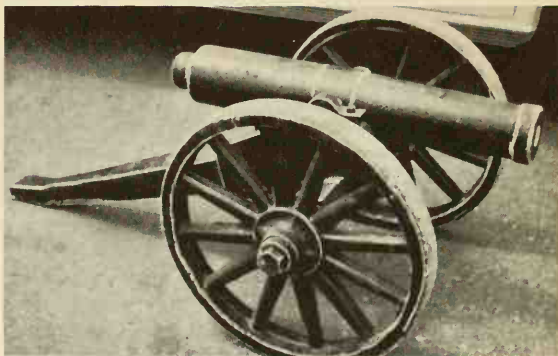
There are *big* bore enthusiasts, then there are BIG bore lovers. The latter aren't satisfied with mere .69 or .72 caliber round ball muskets fired from the shoulder. After all, almost anyone can buy one of those and shoot it without difficulty.

The people we are talking about love muzzle-loading cannons of the Civil War period. Their ultimate ambition is usually to own a bronze Napoleon 12-Pounder, complete with carriage, and in shooting condition. Unfortunately, in their view, such guns are exceedingly rare today, most being in museums, national parks, and monuments and worth thousands of dollars each.

Over the years, cannon enthusiasts have made their own guns, ranging from half-inch bore miniatures up to full-size 12-pounders and larger. There is sufficient demand for such items that today you can order from a reputable supplier a cast bronze or steel tube, either rough or finish-turned and bored, along with a set of authentic looking wheels, and put your own 1200-pound artillery piece together in the garage. A full-scale 3-1/4-inch bore James tube only will weigh 800 pounds and cost \$325 or thereabouts as sold by Dixie Gun Works. Considerably smaller and less costly is the 1/4-scale Napoleon, sold complete and ready to shoot for around \$250. Its bronze tube is 16½" long and the assembled gun measures 30" overall. Not as big or impressive as a full size Napoleon but all parts work and the gun can be shot with round balls or blank charges. This gun isn't exactly a miniature and is big enough to tow along in a parade.

Up a notch in the size scale is the Dixie "Little Mite," an all-iron typical muzzle-loading smoothbore cannon of 1-1/4" bore. It has a 26" tube and measures 46" overall. Wheels are 18" in diameter. This may sound small, but the complete gun weighs in at 350 pounds. Smaller guns than this were actually used in warfare during the American Revolutionary Period.

Probably most representative of the cannon used by today's enthusiasts is the Dixie "Civil War Cannon" of 2-3/16" bore. It utilizes a 43" cast barrel and a built-up carriage with 40" wheels. It is generally loaded



Typical of small-scale muzzle loading cannons that have become popular is the "LITTLE MITE" all metal rig sold by Dixie Gun Works. No lightweight, it weighs in at about 350 pounds, has a 26-inch tube and is 20 inches high. Bore is 1¼ inches and it makes one hell of a noise.



Dixie Civil War Field Cannon with 43-inch tube and 2-3/16-inch bore. Mounted on a semi-modern carriage consisting of a welded trail and cheeks and old wood wagon wheels. It's quite popular among cannon buffs.

with a 4-ounce charge of DuPont cannon powder. Cast iron balls of proper size are available but baby-food or juice cans filled with concrete are the most popular and economical projectiles.

A number of small makers produce a few cannon in their spare time, one of which is Bob Tingle, Shelbyville, Indiana. However, Dixie Gun Works is the best single source for a number of models, as well as for balls, accessories, and parts. Turner Kirkland can produce about any cannon you might want or be able to afford.

Cannon gunnery is a bit different from regular muzzle loading shooting. Reading contemporary accounts of artillery actions of over a century ago will readily convince anyone that a cannoneer's lot was not a happy one. Accounts of burst guns and premature firings, along with legs crushed by recoil, and explosions of powder in the gun pit seem to indicate the cannoneer wasn't a very good insurance risk.

All of those hazards can be eliminated in firing replica cannons and certainly this should be done. Only small powder charges should be used, mere fractions of the service charges used in comparable bored original guns. For example, a 6-pounder Civil War cannon service charge was 1-1/4 pounds of powder — yet less than half a pound of cannon powder is more than enough to produce satisfactory results on today's cannon range. This reduction of powder charge eliminates the probability of burst tubes and heavy recoil which were the bane of early-day cannoneers.

Careful servicing of the piece will eliminate the other hazards. Here are things *not* to do:

Never place any part of your body in front of the muzzle of a loaded gun or while loading.

Never prime, cap, or fuse the piece until ready to fire.

Never leave the gun loaded — load only when intending to fire immediately.

Never insert a fresh powder charge without first swabbing the bore *full length* with a *wet* sponge or mop.

Never fail to thumb the vent while loading.

Never stand directly behind the piece as it is fired.

Never smoke or allow any high heat or open flame near the powder.

Never overload.

Never use oversized projectiles.

Never use smokeless powder or fine-granulation black powder.

Never joke around or indulge in horseplay.

Never use a cannon not known to be in perfect condition.

Never experiment with explosive or elongated projectiles.

Never fail to use plain, ordinary common sense in everything you do around the cannon.

Assuming that you or a group have somehow ac-

quired a serviceable muzzle-loading cannon, how is it to be handled?

Most current models are intended to be ignited by time fuse — quite like the common dynamite fuse, though, a percussion firing mechanism available from Dixie can be used. The fuse burns at the rate of about 30 feet per minute and each new batch should be tested against a stop watch. Do this before ever attempting to load the cannon.

Clean the bore and vent free of grease or oil. We'll assume you've had the good judgement to retire with your artillery to a place where neither sound nor shot will create any hard feelings or injury to persons or property.

Assemble your powder charges in small paper bags that have been nitrated by soaking in a solution of Potassium Nitrate and allowing them to dry. These prepared charges must be kept in a closed box or chest well away from the gun so that a stray spark from the muzzle flash cannot set them off.

The bag serves to contain the powder while it is being rammed to the rear of the bore. Since the tube is nearly horizontal, shoving a small charge of loose powder down the bore would be quite inconvenient. Original cannons were provided with a powder ladle on a long handle. It was inserted to the breech of the barrel, then turned over to dump the powder there.

Place the bagged charge in the tube, then use the rammer to seat it solidly against the bore breech face. The nitrated paper bag will usually burst once it reaches the breech, and this is all to the good.

Follow the powder charge with wads equal in thickness to the bore diameter, rammed down tightly. Wads should be snug in the bore. Best are wads cut from composition board such as Celotex, but similar lightweight material can be used. Some cannoneers simply use crumpled newspapers rammed tightly, but this requires a lot of work.

Excellent wads can be made from newspaper beforehand. Make a mold from a length of pipe which is capped at one end. Soak newspapers in water, and then tamp solidly into the mold to the proper depth. Let dry or heat in an oven to speed things up. When the wad is dry, unscrew the pipe cap and push the wad out with a stick. The wad will be precompressed and will hold its shape. It will be much easier to load and ram than loose newspaper.

Powder charge and wad are all that is necessary to fire a blank. No projectile is needed to produce a satisfying report. For demonstrations and saluting, certainly no projectile should be used. We'll talk about projectiles later.

With charge and wad in place, give attention to the vent. If ramming hasn't pushed loose powder up so as to be visible in the vent, thrust a probe down into the charge. Then dribble fine powder (fffg) in until visible in the vent. Take your length of fuse (remem-

ber the burning time) and thrust one end of it through the vent into the powder charge. Some gunners then like to dribble a bit more fine powder into the vent around the fuse, but it isn't at all necessary. It does make more smoke when the gun fires, though.

Split or fray the free end of the fuse and the gun is ready to fire. The splitting makes the fuse ignite much easier and may be done ahead of time.

Double check to make certain no one is near the muzzle or directly behind the gun. Then from the side, reach over and light the fuse. You must stand clear in the event of the million-to-one chance that the fuse will "flash-through" rather than burn slowly. If it did flash-through and you were standing behind the gun, it *could* run over you in recoil. Mangled feet and legs were common on shipboard in the days of muzzle-loaders — a rolling deck making it difficult for a man to keep clear of recoiling guns.

A match or taper is fine in perfectly calm weather, but a smoldering slow-match is best for lighting the fuse under normal circumstances.

The fuse burns down into the vent and your cannon goes off with a hell of a roar. The powder charge you probably thought too small will surprise you with its violence. The blast will hurl chunks of wadding several yards, some of them smoldering and likely to start a grass fire. You'll do well to have a wet piece of old blanket handy with which to beat out any flames that start.

Do it again. But reloading brings up a new problem — premature discharge due to embers smoldering down in the tube. The very first step after firing is to swab the bore full length with a snug-fitting sponge or sheepskin mop well-soaked with water. Two or three passes are necessary to make certain all embers are extinguished. Some water should splash up through the vent, evidence that orifice has also been cleared of hot embers. You can follow with a dry swab if you like, and the heat of the tube will speed drying. All of this *must* be done before reloading. In addition to being a necessary safety measure, it cleans out the fouling so reloading is much easier.

Blow through the vent to clear it of water, and then stopper it firmly with your thumb while the next powder charge is being rammed. This is just additional insurance that an ember still smoldering after swabbing isn't fanned into life by air forced through the vent as the charge is rammed. *Any* glowing ember in the tube will cause the charge to explode while being rammed. Such an occurrence not only spoils the rammer staff, it can also spoil the fellow doing the ramming.

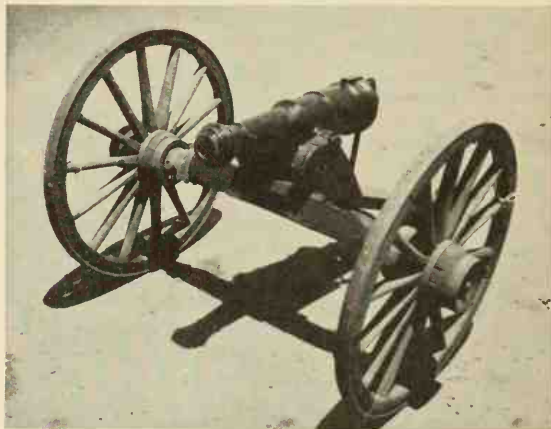
Proceed as already described from this point.

What to do if the gun misfires? First, leave the blasted gun alone for a half-hour. You may only have a delayed-fire and it could go off disconcertingly while you are trying to correct it. Then, pull any fuse remnants out of the vent and brush away any loose powder

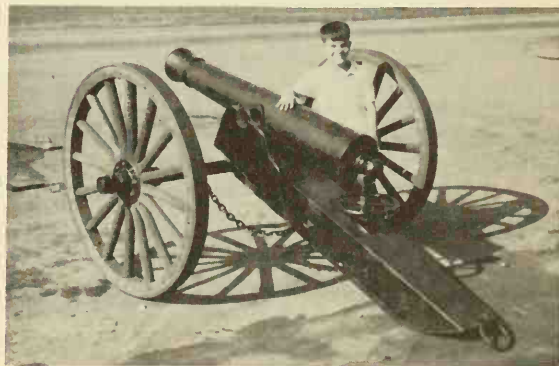
or ash. Plunge the vent probe deep into the charge and work it around to loosen the powder. Dribble fine powder into the vent, insert new fuse and try again. Make certain the fuse sticks down well into the charge.

If all this fails, prepare to draw the charge. Use the cannon worm to pull out wadding. The worm will also usually serve to pull out a round ball, but if you're using concrete-filled can projectiles, difficulty may be encountered. Try a small, powerful magnet on the end of a rammer staff. If that doesn't work, try a sharp-edged, right-angle hook which can be forced through the metal of the can to give purchase to draw it out.

Once the projectile is out, use the worm on the rest of the wadding, and then flush the powder out with water. Pour water into the elevated tube and loosen



Old British naval gun on Dixie Civil War style carriage.



A full-scale reproduction of the Civil War James gun, weighing nearly ½-ton. Steel tube-lined bore measures 3¼ inches. Can be had from Dixie Gun Works for about \$500.

the charge with a sharp stick. Then lower the muzzle to let the slush run out. Finish by cleaning tube and vent thoroughly.

Let's get back to loading and projectiles. Iron balls about 1/4" less than bore diameter are available in some sizes but are costly. Baby food and juice cans can be found which fit loosely into the more standard bores. Filled with concrete, they make entirely satisfactory *cheap* projectiles. Cans may also be filed with sand if they've not had their tops completely removed. A sand-filled projectile is easier to pierce and withdraw than one of concrete in the event of a misfire.

Once powder and wadding are in place, the projectile is seated on the wadding with the rammer. If you're shooting at relatively high angles of elevation, the gun may then be fired without a top wad. Person-

ally, I prefer a tight-fitting wad over the projectile. This can be a single fiber disc, or a pressed newspaper wad of the type already described. Don't make it too thick — 1/2" to 1" is plenty.

Don't get the idea that such projectiles are harmless. Either will punch through both sides of a barn as one individual who shall remain nameless found out. Even the very light powder charges give projectiles a most respectable amount of energy. Even loaded with blanks, these cannons are not toys. A quarter-sized chunk of wadding can cause serious injury when striking a person. I've seen wad fragments breeze right on through 1/4" plywood 10 feet from the muzzle. Muzzle-loading cannons are true firearms, just as deadly as a machine gun, if improperly handled. Keep that in mind and they can be lots of fun.



CHAPTER 19

RESTORATION AND REFINISHING

You'll probably start shooting with a modern reproduction and might even eventually *build* your own battery. And, even though a dozen guns later you'll still be shooting the modern pieces, there's no doubt but that one day you'll just *have* to have an original gun or two. Collecting proper is far too involved a subject to go into here, but it is useful to know how to put an old piece back into acceptable condition.

New-condition originals are scarce as WCTU members at a Hiram Walker sales meeting and priced at hundreds of dollars. So, it's likely you'll buy something needing a bit of restoration, even if you don't intend to shoot it. The fellows who do this sort of work for a living command high wages so you'll probably want to do the job yourself.

This is all fine except that more basically sound pieces than you can count have been spoiled by uninformed attempts at restoration.

"RESTORATION" means just that — *restoring* the piece as near as possible to its original condition. It *doesn't* mean varnishing the stock, gold-plating the trigger, and giving the barrel a high-polish blue job.

Honest restoration consists of cleaning wood and metal without changing contours and without removing markings or evidence of honest wear. Of replacing *only* small parts such as pins, screws, springs, etc., to place the piece in operating condition, and repair cracks, splits, and serious dents or deformation. In instances where the original finish *can* be duplicated without otherwise spoiling the piece, it may also be part of legitimate restoration.

Recutting a barrel to clean up a rusted-out bore is restoration, while installing a new, modern-production barrel is *rebuilding* and, in my view, decreases the value of the piece.

So, you've made a good buy and now have a muzzle loader that needs some work to make it look and function right.

First, it must be carefully cleaned and disassembled. If not too dirty, disassembly comes first, but it may be so cruddy that it can't be taken apart until cleaned. Either way, disassembly is covered in Chapter 4. About

all that can be added here is that hurried or improper disassembly can easily ruin a good piece. This is particularly true of stocks. Never, under any circumstances, try to separate wood from metal by mere force. If they do not come apart with moderate effort, *something* is holding them together. It might be a concealed pin or screw, an undercut, or simply thick rust. Whatever, find out and take care of it *first*. Then the parts will separate without damage.

After everything is apart, cleaning begins — before repair is attempted. Dirt and grease come off metal first. Use soap or detergent and water. Scrub with a stiff bristle brush and take your time. Don't be tempted to scrape with a steel knife blade or similar instrument; remember that only the dirt and grease is to come off. Areas where a brush can't reach can be cleaned with small scrapers filed from hard plastic; brass, never steel; or copper. Flattened cartridge cases are good for this. Don't overlook recesses, screw, and pin holes. An assortment of bore brushes will clean out almost any screw hole. A tight-fitting brush rotated in a hole will dig out all the crud, even from threads. In a real stubborn case, use a *brass* bore brush.

Often a gun that is horribly encrusted with dirt and oxidized grease and oil will turn out to be beautifully preserved — simply because the dirt protected it. If that's the case, you're in luck.

More likely, though, you'll find varying degrees of rust some of which will have come off with the soap and water scrubbing. Internal parts having never been browned or blued can be de-rusted very quickly. Simply coat them with "Naval Jelly" and wipe it and the rust off at the end of the prescribed period. Repeat application if necessary. No sweat. Other parts so heavily rusted that the original finish has obviously been eaten away may be given precisely the same treatment. The Naval Jelly will lift off every bit of rust, leaving bare metal. It will also remove original finish which is a form of rust itself so can be used only when you're sure there is none left.

More often than not, though, some finish will still be present and should be preserved. In such cases, rust

removal is more a matter of patience and effort than technique. Large, coarse rust flakes are best flicked off with a probe made by setting a large needle in a wood handle. Relatively fine rust should first be soaked in light oil for a time — at least a few hours, and if you're not in a rush, longer certainly won't do any harm. Then, take the finest steel wool you can find and gently rub off the rust. Keep adding oil and replace the steel wool as it becomes clogged with abrasive rust flakes. Flush the surface clean frequently to avoid forming an abrasive paste that will wear away the remaining finish. Use the steel wool in uniform strokes along the length of the part — the direction in which original polishing was done. Don't rub it round and round, and don't apply much pressure. Fine wool, properly used, will remove rust *without* spoiling the remaining finish.

Once all rust has been removed, it's time to appraise the situation and decide what else needs to be done. If all finish is gone and the surface is deeply pitted, it should be left as it is. Simply preserve it with a coat of oil or, if you prefer, a sprayed coat of clear lacquer. If a significant amount of old finish is present, the same procedure is in order. If most finish is gone and yet pitting is only light to moderate, refinishing *may* be in order. A browning solution may be applied directly over the metal without further treatment. The roughened surface will not produce the original smooth finish, but will take on color and will be somewhat protected by the new finish. The treated areas will then blend in with remaining original finish.

On the other hand, light pitting can be polished off and the original finish duplicated. The advisability of this depends, upon whether the polishing can be done without destroying any markings — and on whether you are competent to do a proper polishing job. No offense intended, but polishing is neither easy or fast. Years ago, I knew a man who did a masterful job of polishing and refinishing old guns. He used no power tools whatever. An octagon barrel, for example, was polished by thousands upon thousands of full-length strokes of *flat* Arkansas stones. The end result, which might consume weeks of his spare time, was a perfectly polished barrel with all edges as sharp and clean as new.

If you are willing to take the time to use similar methods, polishing by hand with shaped stones or abrasive cloth glued to shaped blocks, you *can* do the job. But, there are no shortcuts and the process simply can't be rushed. Every edge must be preserved and the original profiles and angles must not be changed. A proper job cannot be done on powered wheels by anyone but a professional polisher.

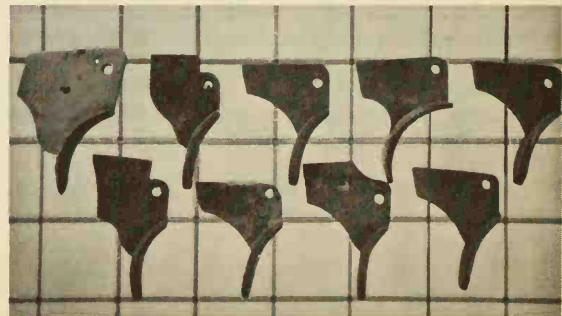
Application of a new finish depends upon the solution used. Browning is the most common and several solutions are available from the suppliers listed in the Directory, Appendix 2. Many home-brewed solutions

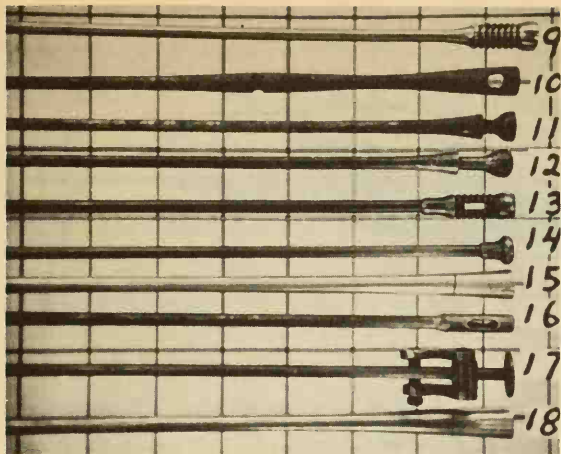
are listed in "Firearms Bluing and Browning (Angier)." Most important is to follow the maker's instructions. After you've loused up the job is a poor time to read the fine print. Generally speaking, allow more coats and more time for the job than the instructions specify. I recommend you get a copy of the book just mentioned from The Stackpole Company.

However, we still have the matter of repair or replacement of metal parts to consider. It's generally agreed that pins, screws, and springs may be replaced without detracting from the value of the piece. Pins and screws should be of the same type and dimension as the original.

A roll pin or a phillips-head screw would certainly be frowned upon in a Kentucky rifle. Replacement screws and screw blanks are available in a wide variety of sizes to meet most needs. For example, complete sets of screws are sold for Colt percussion revolvers. The same applies to springs. Exact replacements are often available, even of original manufacture, and blank springs can be filed to fit. Nipples, being highly perishable, are replaced without harming the piece. Some modern replacements are identical to the originals.

The more obvious parts are another matter. A missing hammer must be replaced if the gun is to look complete. But, the replacement *must* be a duplicate of the original. The parts dealers can often supply an original hammer, frizzen, etc. If they can't the problem still isn't too severe. Dozens of styles of hammers, triggers, top jaws, etc., are currently produced by the lost-wax casting process. More often than not, the proper size may be obtained. However, if the style or profile isn't exactly right, the careful workman can change it by filing, grinding, or welding. Once this is done, though, the part should be marked in an inconspicuous place so that it is identifiable as a modern replacement. No matter how good it looks or how hard you worked on it, the part is not original to the gun. It is dishonest to claim or imply that it is. This same general rule is applied to any replacement part other than pins, screws, springs, and nipples.





Replacement parts such as these triggers and ramrods are readily available, as are most other component parts. Many are of new manufacture, usually lost-wax casting technique, but hundreds of thousands of original parts are stocked by several firms such as the Dixie Gun Works.

Hammers worn loose on the tumbler or badly eroded on the face may be welded up and restored to original functioning and shape without losing their originality. The same applies to a refaced frizzen. These operations constitute a *repair*, not a *replacement*.

Stocks are often in worse shape than metal parts. Splits and cracks in the lock and wrist area are common. Of course, cleaning is the first step in restoring any stock. Mild soap and luke-warm water applied sparingly with a bristle brush will get rid of the dirt. Don't soak the stock. Work up a dry lather on the brush and use that. Go over the entire stock, inside and out and use scrapers in holes and recesses where the brush won't reach. Wipe with a cloth moistened with solvent.

The wood may turn out to be heavily oil soaked. Repairs and refinishing aren't practical until the oil is removed. The traditional method is to heat the wood until the grease bubbles to the surface and can be wiped off. A great deal can be removed this way, but some always remains just under the surface. Also, the stock may be warped by heat.

Far better is the use of carbon tetrachloride. This material gives off toxic fumes so must be used with care. First scrub all surfaces. This will remove grease to some depth, depending upon hardness and density of the wood. Further treatment is by immersing the stock in the solution. If the entire stock needs treatment, get a piece of light-weight pipe a bit over half as long as the stock and large enough to accept the widest part of the stock. Cap one end and fill with carbon tet. Immerse the stock, half at a time, and let it soak for a couple hours. Then, take it out and let the carbon tet evaporate, carrying the grease with it.

Repeat until the wood is free of grease deep enough to allow a new finish to be applied.

This treatment will bleach dark wood slightly, but only on the surface. It will also thoroughly raise the grain making extensive sanding necessary.

Take particular care to insure that all grease and oil are removed thoroughly from any areas requiring repair. In the case of a split or crack, wedge it slightly open and squirt carbon tet in through a hypodermic syringe and needle. Repeat until the fluid comes out clean.

Cracks and splits are easily repaired if they can be forced open enough to insert a hypo needle. Force epoxy cement in through the needle, and then clamp the parts together tightly. Use shaped blocks of soft wood to apply pressure with C-clamps, rod clamps, or a vise. Do not clamp so tightly that the wood is crushed or dented.

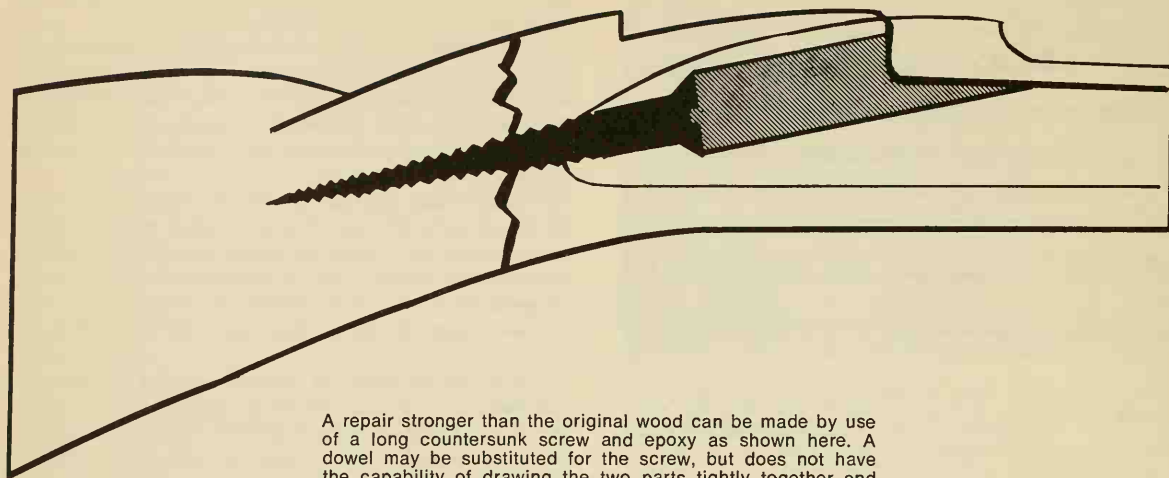
A complete break at the wrist is not uncommon and calls for drastic treatment. An almost-complete break is easier to repair if broken all the way and given the same treatment. First make sure the break surfaces are clean and free from oil or grease. Salvage all the pieces and splinters and make certain by trial assembly that they'll fit back in place.

Clamp carefully together, snugly, but not too tightly, and check alignment. Select a long woodscrew that will reach at least 1-1/2" past the break when run through the center of the wrist from the tang inletting recess. Carefully drill a pilot hole for this screw. The portion of the hole past the break should be large enough to avoid having the screw split the wood, yet small enough to allow the threads a good bite. The hole must be larger in very hard wood than in soft. The balance of the hole should allow free passage of the screw and, of course, the head must be countersunk to prevent it from interfering with the tang inletting.

Try the screw and if everything works, separate the parts and apply a modest coat of epoxy cement on the mating surfaces. Fit them together and turn the screw in tightly to draw them together. Make sure the screw doesn't twist the parts out of alignment. A bit of soap wiped on the threads will help avoid this and will make driving the screw easier. Carefully epoxy back in place any exterior fragments of wood, then set aside for the epoxy to cure. A break repaired this way will be stronger than the wood surrounding it.

Even when carefully done, such a repair may show. If there are pieces of wood missing, matching scrap material must be carved to shape and glued in place. Once this is done, the joint must be carefully filed, scraped, or sanded flush. Any minor gaps can then be filled with the matching color stick shellac rubbed in place with a heated knife blade or small spatula.

Wood missing from other visible areas should be replaced. Often pieces have been broken or burned away around the nipple or flash pan, and sometimes



A repair stronger than the original wood can be made by use of a long countersunk screw and epoxy as shown here. A dowel may be substituted for the screw, but does not have the capability of drawing the two parts tightly together and therefore requires heavier clamping.

along the edges of the barrel channel. The edges of the area must be carefully trimmed smooth with knife or chisel. Fit a new piece of matching wood in place, coating the mating surfaces lightly with chalk to mark the high spots. Use epoxy cement and clamp in place. Once the joint is cured, file and sand the repair flush with original wood.

Minor gouges in the wood can be filled with stick shellac as already outlined. Dents, where the wood fibers are not badly crushed or broken, can be raised by steaming. Shallow dents are covered with a few layers of wet cloth, and then a hot iron or soldering iron is applied directly over the dent. Steam is formed, penetrates the wood fibers, and expands them back to original shape. Deep or very large dents may require more drastic treatment. A jet of steam applied directly to the wood is more effective. A hose can be clamped over the safety valve stem of a pressure cooker and used to direct steam into the dent. In either method, numerous treatments are often necessary to raise the dent. Patience and perseverance will pay off, however, so don't give up with the job half done.

Once all repairs are finished, consideration can be given to renewing the finish. If substantial original finish remains, we don't want to spoil it. In this case, use very fine steel wool to smooth the bare wood areas feathering into existing finish smoothly. Since the original finish is probably well-oxidized linseed oil, use a good grade of "boiled" linseed oil applied sparingly and rubbed in well with a lint-free cloth or the heel of the hand. Both stock and oil should be warm to facilitate penetration. This should be repeated at intervals of

several days until the new finish matches and blends in with the old.

If a complete new finish is required, sanding is the most important step. Just getting the wood smooth isn't enough — all the original edges and contours must be preserved. This will often require the use of hardwood sanding blocks shaped to fit specific areas of the stock. Glue sandpaper to these blocks to insure against buckling and stripping; rubber cement is best since it allows easy removal and replacement.

"Gritcloth" is the best sanding medium I've found, since it's open mesh does not load up. Sand only with the grain of the wood. Work through progressively finer grades until the wood feels glass-smooth. At this point, many fibers are bent over and compressed into the wood.

They need to be raised and cut off flush with the surface. This is accomplished by wetting the surface, and then holding the stock near a source of high heat to turn the water to steam. And, the steam lifts the offending fibers. This is called "Whiskering." Wet, heat, and sand lightly to cut off the whiskers. Use fresh, clean paper. Then, repeat two or three times or until further wetting and heating does not raise any more whiskers. Only when this point is reached can finish be safely applied.

While linseed oil was the traditional finish, modern oil-type, quick-drying finishes approximate it very closely when properly used. "Lin-Speed" has given good results when used sparingly and rubbed in well. If applied in accordance with the instructions and rubbed down with fine steel wool, it produces an ex-

cellent finish. Several other makes produce equally good finishes. Once the finish is completely dry and has been rubbed down, a coat or two of good paste wax will help keep it looking fresh. Stoege Stock Wax is excellent for this purpose.

Thus far, we've treated the stock as if there were no decorative inlays, patchboxes, etc. Often, though, there will be brass or silver stars and other decorations inlaid flush with the surface of the wood. Unless they are quite loose, don't try to remove them. Those that are solidly in place should be left alone. Those slightly loose can be tied down by injecting epoxy cement under them through a fine hypo needle, then clamping or weighting them down until the cement cures. Those that are very loose can be carefully lifted out. Scrape the stock recess and back of the inlay clean, coat with epoxy and clamp in place.

This should all be done before sanding the stock in the vicinity of the inlay. Rough sanding can be carried right over the inlay if no engraving is present.

When sanding is finished, the inlay should be flush with the wood, and the sanding marks can be buffed out with jeweler's rouge.

With all parts carefully cleaned, repaired, and otherwise refurbished, the gun can be re-assembled. Careful attention should be paid to fit of metal to wood, particularly in the breech plug/tang area. If wood has rotted or chipped away so that the metal is not fully supported, glass bedding compound should be used to fill the gaps. The same applies to any significant gaps elsewhere, but is especially important there because the breech plug and tang transfer all recoil loads to the stock. Any good grade of glass bedding material may be used, and all come with complete instructions for their simple use.

You may spend six months of your spare time in the manner just outlined to put a worn Hawken or Zouave back into original working condition. But, the result will be a source of pride well worth the effort.



APPENDIX I

GLOSSARY OF MUZZLE LOADING TERMS

This Glossary is included here by the courtesy of Maj. R. O. Ackerman, Albuquerque, N.M., who compiled it for his own series of Muzzle Loading Books.

AMPCO NIPPLE — A modern type of percussion nipple, made of a special alloy, which has the appearance of brass but is much harder, tougher and highly resistant to erosion of the flash hole from the heat of ignition.

APERTURE SIGHT — A "peep" rear sight with a small hole through which the eye automatically centers the front sight. The most accurate type of metallic sight.

ARQUEBUS — A very early matchlock firearm, later including certain wheellocks. Usually refers to an arm of better workmanship, rather than crude military pieces.

BACK-ACTION LOCK — A later type of percussion side-lock, in which the mainspring is to the rear of the tumbler and hammer.

BALL — The spherical lead projectile used in the majority of muzzle loading rifles and pistols.

BALL AND SWAN DROPS — A combination load consisting of a ball over which were a number of the large shot used in swan hunting, approximately .27 caliber, followed by a wad. Used occasionally in warfare, in coach pistols against highwaymen, and (in certain areas) in the earlier formal pistol duels.

BALLISTICS — The science of a projectile's actions after the propellant's explosion, and the various factors which influence its accuracy.

BALL SCREW — An attachment for the threaded end of a ramrod, to remove a lead projectile without firing the arm.

BALTIC LOCK — A primitive, early version of the flintlock, in use about 1600.

BAND SPRING — A spring which is depressed to remove a barrel band from a musket.

BAR-ACTION — The more usual side-lock type, in which the mainspring is in front of the tumbler and hammer.

BARLEYCORN — A conventional early front sight of simple bladed type, very low in height. So named because its shape often suggested a barley grain before threshing.

BARREL — The metal tube from which the projectile emerges upon firing.

BARREL BAND — One of the several bands holding barrel and fore-end together on most military muskets.

BARREL KEY — A flat key which holds barrel and fore-end together on many half-stock rifles and shotguns.

BARREL PIN — A round metal pin which fastens barrel to fore-end, more usually on earlier full-stock arms.

BELTED BALL — A lead ball cast with a single raised belt around its circumference, to be mechanically fitted into the deep two-grooved rifling of certain muzzle loading rifles, particularly British Smith, Purdeys, etc.

BENCH RIFLE — A type of target rifle, often quite heavy, designed especially for firing from a bench rest with the shooter seated.

BLACK POWDER — The standard propellant of the muzzle loader. It is basically a mechanical mixture of potassium nitrate, charcoal and sulphur.

BLUNDERBUS — A firearm with a flared muzzle, often used to repel boarders in naval warfare. It is erroneously pictured as the standard arm of the pilgrim fathers, which it definitely was not.

BOOTLEG — A slender muzzle loading pistol, usually with a compact underhammer action, which could be carried inside a boot if desired.

BORE — The hole in a tubular gun barrel, through which the projectile passes.

BORE GAUGE — An instrument for determining the exact diameter of a bore.

BORE SIGHTING — Adjusting of the sights to coincide exactly with a point upon which the bore is aligned at a given distance. With a muzzle loader, this may be done by removing barrel and breech plug.

BOX LOCK — A lock mechanism with the hammer inside of the lock plate, and projecting above it.

BREECH — The rear end of the barrel.

BREECH PLUG — A threaded plug which provides a gas-tight seal for the rear of the barrel, and to which the tang is usually attached.

BREECH PRESSURE — The pressure exerted by the rapidly expanding gases of the ignited propellant, measured in p.s.i. (pounds per square inch).

BREECH SEAL — A metal seal which is designed to provide obturation to an arm such as a Civil War breech loading carbine, so that it may be used as muzzle loader.

BRIDLE — A plate that provides support for the inside end of those screws upon which the sear and tumbler pivot in a conventional lock.

BROWN BESS — The smoothbore flintlock musket of the British forces during our colonial period.

BROWNING — An oxidation process for finishing barrels and metal part, which predated modern bluing.

BUCK AND BALL — A musket load as sometimes used in the Civil War, usually consisting of one spherical musket ball behind three buckshot. A deadly short-range load.

BUCKSHOT — Large round lead shot, usually ranging from .24 to .36 caliber. In multi-ball loads, these were used in riot control, combat and big game hunting.

BUGGY RIFLE — A small, light rifle, often in the form of a long-barreled single-shot pistol with rifle sights and a detachable shoulder stock. Popular about the 1870's for protection, small game, and informal target shooting.

BULLET — The projectile itself, not the entire cartridge as the term is often erroneously used.

BULLET MOULD — A metal tool containing a cavity or cavities for the casting of lead balls or other firearm projectiles.

BULLET PATCH — A patch of cloth, buckskin or similar material, surrounding a ball in a muzzle loader bore, which engages the rifling and serves as a gas seal.

BUTT MASK — On earlier pistols, a metal butt cap representing a grotesque face.

BUTT PLATE — A protective metal plate on the rear of a buttstock.

BUTTSTOCK — The widening portion of the wooden stock which goes against the shoulder.

CALIBER — The diameter of the bore of a firearm, expressed in thousandths of an inch.

CANNELURE — A shallow grease groove around the circumference of a conical bullet.

CAP BOX — A hinged metal trap in the stock of a percussion shotgun, in the butt of a Deringer pistol, etc. Also, a leather belt-pouch for musket caps in the Civil War period.

CAPLOCK — Another term for a percussion firearm.

CARTRIDGE BOX — For our purposes, the leather pouch in which a musketeer carries paper or combustible cartridges.

CASE-HARDENING — A metal-heating process in conjunction with bone and leather scraps, or more recently, chemicals which imparts a beautiful finish in

mottled colors while making the metal surface quite hard.

CAST-OFF — A variation to the right in a gun stock from alignment with the barrel, to better fit a right-handed shooter. To the left for a southpaw is called **CAST-ON**.

CHAMBER — An unrifled portion of the barrel, at the rear, where the powder charge receives ignition. Seen in some muzzle loaders, but not usually.

CHARGER — A powder measure for one exact charge. May be on a horn, on a flask, or a separate instrument. Fixed or adjustable.

CHECKERING — The decorative roughening of a handgrip. Seldom seen on muzzle loaders except for shotguns and some duelling pistols.

CHEEK PIECE — A raised portion behind the comb of a stock, to align the eye with the sights.

CHERRY — A steel burr of precise shape, to cut the cavity in a bullet mould blank.

CHOKE — The varying constrictions near the muzzles of shotguns, to control the range at which an ideal pattern occurs. Different chokes are desirable for different conditions. Fine custom-made muzzle loading rifles are often given a touch of choke for superior accuracy.

CLEANING PATCH — A cloth patch, usually flannel, for wiping the bore between shots, or thorough cleaning after the day's firing.

COACH PISTOL — Usually a smooth-bore, this was a pistol once carried by travelers for protection. Not recommended for target accuracy.

COCK — The action of drawing back the hammer. Also an early term for the hammer of a flintlock.

COMB — The raised top of a stock just back of the wrist or trigger-hand grip.

COMBUSTIBLE CARTRIDGE — A muzzle loading cartridge encased in nitrated paper or other material, which is completely consumed by the flame of ignition. Most used in percussion revolvers.

CONE — Early term for a percussion nipple.

CORNED POWDER — Crude early type black powder, which was the first attempt at formation into grains.

CORROSION — The deterioration of a bore or other metal surface from oxidation or other chemical reaction. See **EROSION**.

CREEP — The erratic, rough pull of a trigger when sear and tumbler notches have not been properly stoned smooth.

CULOT — The iron wedge in the hollow base of a Minie bullet, per French Captain Minie's original design. American ordnancemen later eliminated this expanding wedge.

CURLY MAPLE — Favorite stock wood of the early American "Kentucky rifle" makers. They selected only certain kinds of Maple, and preferably from sparse, rocky terrain, for maximum figure in the grain.

CYLINDER — The revolving portion of a percussion revolver, usually containing six chambers.

CYLINDER BORE — A shotgun barrel which is not choked.

DAMASCUS — An early barrel steel, made from strips of various steels welded together in a pleasing design. The harder metals resisted browning more than the milder ones, which accounted for the beautiful effect, but we vastly prefer a plainer and stronger barrel for actual shooting!

DETENT — A detent, or fly, should be added to the tumbler when a set trigger is installed. It cams the sear nose down during firing, to miss the half-cock notch. It does not interfere with half-cocking otherwise.

DETONATING POWDERS — Very powerful high explosives which are initiated by a blow, not requiring ignition. They made the percussion cap possible, and modern primers. Alexander Forsythe developed the first practical detonator lock for firearms about 1805, and patented it in 1807, but it did not gain general acceptance for many years. Although mercury fulminate was already known, Forsythe refused to use it, preferring his mixture of potassium chlorate, charcoal and sulphur.

DISC PRIMER — Used on many of the separate-primed Sharps rifles of the transition period. Hammer action caused a tiny magazine to place a disc primer over the nipple for each shot. This was the "Lawrence patent."

DOG LOCK — A manually-operated catch engaged the rear of the hammer on some early flintlocks.

DOUBLE ACTION — An arm in which one long pull of the trigger cocked the hammer, turned the cylinder if there was one, and fired the piece.

DOUBLE-NECK HAMMER — Or reinforced hammer, was used on many later flintlocks, especially military arms. It was less graceful but stronger than the more standard "goose-neck" flint hammer. With improved steels, most percussion arms returned to the goose-neck style.

DOUBLE RIFLE — There were several types of double rifles made in the U.S., both in flint and percussion. The side-by-side double rifle was largely a British preference, for the big game of Africa and India. Many top quality British percussion rifles found their way here with their sportsmen, when our buffalo, elk and grizzly were plentiful.

DRIFT — The lateral error in a bullet's flight, due to its rotation from the rifling.

DROP — The distance from the line of sight to the top of the comb and the top of the heel of a stock.

DUELLING PISTOL — A superb quality single-shot in either flint or percussion, designed solely for aristocratic mayhem. Contrary to common belief, these were seldom covered with light-reflecting inlays and filagree. A small percentage of the "duellers" now around actually were for that purpose.

DUPLEX LOAD — One in which a tiny priming charge of "bulk" smokeless shotgun powder is loaded ahead of a reduced charge of black powder, for cleaner shooting, etc. Only for the thoroughly experienced shooter. Currently outlawed in many larger matches across the nation.

ELEVATION — Raising the rear sight raises the point of impact. Raising the front sight lowers it.

EPROUVETTE — A device, in either flint or percussion, by which the comparative strength of powder samples may be tested, usually by a rotating gauge and stationary needle. Not too accurate, but a peachy conversation piece.

EROSION — The enlargement of a bore, touchhole or nipple vent from the intense heat of ignition, coupled with projectile wear. Reasonable loads increase barrel life.

ESCUTCHEON — A metal inlay strengthening the hole through which a barrel key or other fastening is inserted.

FALSE MUZZLE — The accessory which is placed precisely upon the muzzle of the finer target rifles during loading, particularly bench rifles to aid in accurately starting the bullet without deforming it, and to prevent damage to the rifling at the muzzle.

FENCE — A projection on the rear of the flintlock pan, to divert the flash from the face of the shooter.

FINIAL — The decorative end of a patch box, trigger-guard strap, lock plate or other metal gun part.

FLASH — Ignition of the priming powder in a flintlock pan, when the main charge fails to explode.

FLASH GUARD — See FENCE.

FLINTLOCK — Traditional arm of our colonial forefathers, in which a flint strikes steel, dropping incandescent shavings into a pan of priming powder. The flash sets off the main charge through a touchhole. Generally considered the first fairly practical firearm.

FORE-END — Or forearm. The portion of the wooden stock which lies under the barrel.

FOULING SHOT — A first shot into the backstop to remove every vestige of oil before firing a match.

FOWLING PIECE — Generally accepted to mean an earlier shotgun — a light single-barrel.

FRESHENING — The rejuvenation of a worn bore by deepening each groove, then smoothing the tops of the lands. This will generally require a new mould or enlargement of the former one's cavity. Simpler than either re-rifling or sleeving, if your bore is not too far gone.

FRIZZEN — Also hen, pan cover, steel, battery, etc. Various names for the steel part which the flint scrapes to fire a flintlock.

FRIZZEN SPRING — The outside spring which controls the frizzen's position.

FULMINATING POWDERS — Detonating agents such as fulminate of gold and of silver were discovered as early as 1600, but found no practical purpose. The discovery of fulminate of mercury was announced on March 13, 1800, leading to the invention of the percussion cap almost 20 years later.

FURNITURE — All the minor metal trim on a muzzle loader, which may be of brass, iron, german silver or sterling silver.

GAIN TWIST — A type of rifling in which the pitch or the degree of twist increases steadily as the bullet progresses from breech to muzzle.

GAUGE — Any measuring device. Also the size of a shotgun bore, determined by the number of spherical balls of bore size which comprise one pound of lead. Example: one pound makes 12 balls that fit a cylinder-bored 12 gauge shotgun. Thus, larger numbers mean smaller bores, the opposite of rifle calibration.

GERMAN RING TARGET — An early type of paper target the popularity of which extended into the Schuetzen match era of the 1880's.

GLOBE SIGHT — A fine front sight like an erect, small-headed pin, shaded by a short metal cylinder. Makers such as Norman Brockway sometimes used a hog bristle for the pin.

GOOSE-NECK HAMMER — The graceful single-necked hammer of the flint and the percussion eras.

GROOVES — The spiral cuts of rifling which cause a bullet to rotate in flight.

GROUP — A good target group is a series of bullet holes in close proximity. Sight adjustments will then move future groups to the target's center.

GUNFLINT — A hand-shaped piece of flint stone with a chisel edge, for firing a flintlock.

GUNPOWDER — The propellant explosive used in small arms.

HAIR TRIGGER — The forward or firing trigger of a double-set trigger assembly. It may be adjusted to release at a very light touch.

HAMMER — The piece which holds the flint in a flintlock or which strikes the capped nipple in a percussion arm.

HAMMER SPUR — The thumbpiece on the upper rear of a typical percussion hammer.

HAND CANNON — The earliest small arm in fire-arm history. More useful for scaring the enemy's horses than as a serious weapon.

HANG-FIRE — A dangerous condition when an apparent misfire goes off after a brief delay. Keep it pointed down-range!

HEEL — The corner of the buttstock at the top of the butt plate.

HORSE PISTOL — A large pistol, chiefly military, used by early horsemen and often carried in a pommel holster.

HUNTING POUCH — The leather pouch, usually decorated, in which the early American rifleman carried patching, spare flints, priming horn and other accessories for his long rifle.

HYDRAULIC BULLET — A muzzle loading projectile drilled to insert water, after which the hole is plugged. This gives increased expansion on a solid target such as game.

IGNITION — The method by which the charge is fired, such as flintlock, percussion cap, slow match, fuse, pyrites, linstock, pill lock, etc.

INCISED — When a surface is cut to a given depth, as on wood or leather, preparatory to relief carving, leather tooling, inlaying, etc.

INLAYS — Decorative shaped pieces of metal, ivory, contrasting wood, etc., let into the surface of a gunstock, and finished flush with that surface.

INLETING — The precise woodworking which permits barrel, lock and other major parts to fit into recesses in the stock which exactly receive them.

IRON PYRITES — A common mineral, a yellowish metallic-looking sulfide. The "fool's gold" of the inexperienced prospector. Striking sparks from steel, it was the ignition agent of both the wheellock and the pyrites lock.

JAEGER RIFLE — An early German arm from which our Kentucky rifle evolved, being drastically modified to suit New World conditions.

JAG — A serrated, ridged or button-ended tip for a cleaning rod, to grip the cloth patch.

KENTUCKY RIFLE — The traditional long flintlock rifle of our pioneer forefathers. One of the few purely American developments in firearm history, reaching its peak of excellence between 1775 and 1830.

KNAPPER — A skilled workman who chips out gun-flints, using hand tools exclusively. Currently, the only remaining professional knappers operate in the village of Brandon, England.

LANDS — The raised spiral ridges between the grooves of the rifling.

LAP — A precisely fitting plug, usually of lead and charged with abrasives, for smoothing out a bore.

LINEN — A cloth material woven from flax fiber, often preferred for ball patches.

LOADING BLOCK — A small strip of hardwood, drilled with several holes which carry pre-patched balls, to save time in loading a rifle.

LOCK PLATE — The flat metal plate upon which the firing mechanism of a conventional muzzle loader is mounted.

LOCK-SCREW — A long screw running laterally through the stock to hold the lock in place.

LOCK-SCREW PLATE — A metal plate opposite the lock plate, which supports the heads of the lock-screws.

MAGAZINE CAPPER — A convenient device for dispensing one percussion cap at a time, directly onto the nipple.

MAINSRING — The heavy spring which actuates the hammer.

MAINSRING VISE — A clamp to compress the mainspring, for easier disassembly of the lock mechanism.

MATCHLOCK — The earliest firearm to include an actual mechanism. A smoldering, nitrated, hemp cord (the "match") was levered into contact with the primed pan.

MATERIEL — The equipment of the military. Not to be confused with the raw MATERIAL from which it is made.

METALLIC SIGHTS — Gun sights which do not contain magnifying glass lenses, etc. A stipulation in the rules of many matches.

MINIE BULLET — The conical projectile of the Civil War infantry rifle and similar minie rifles. The pressure of propellant gases expand its hollow base into the rifling grooves.

MIQUELET — Forerunner of the true flintlock, it had on outside mainspring. It differed from the snaphaunce in having frizzen and pan cover in one piece.

MISFIRE — Failure of a loaded arm to fire when intended. See HANG-Fire.

MULE EAR LOCK — A percussion system with a flat side hammer, which pivoted laterally.

MUSKET — Generally, the long, full-stocked, smooth-bored shoulder arm of the early infantryman. The first issue rifles were sometimes termed "rifled muskets" and their outside appearance was little changed.

MUSKETOON — A shorter shoulder arm of musket pattern, between the infantry musket and cavalry carbine in length. Issued to artillery and sappers (military engineers).

MUZZLE — The front end of a barrel.

MUZZLE ENERGY — The force exerted by the bullet, expressed in foot pounds, calculated at or near the muzzle. A better term is kinetic energy, which more properly describes the same calculation at various distances.

MUZZLE LOADER — A firearm designed to be loaded from the muzzle, or front end, by means of a ramrod. Percussion revolvers are included, as their chambers are loaded from the front of the cylinder. Also may refer to a person who shoots muzzle loading firearms.

MUZZLE VELOCITY — Speed of the projectile, expressed in feet per second (f.p.s.), at the muzzle or at various measured distances.

NIPPLE — The tiny tube of a percussion arm upon which the cap is placed. With its threaded base, it is readily replaceable.

NIPPLE WRENCH — A tool for removing or replacing nipples. Comes in various sizes.

NOSE CAP — The metal cap on the front end of a muzzle loader fore-end, particularly on a full-stock arm.

OCTAGONAL BARREL — Seen on many of the earlier muzzle loaders, this is the conventional 8-sided barrel.

OPEN SIGHTS — The standard V-notch rear and plain blade front sight.

PAN — The receptacle which holds the priming powder, in the flintlock and previous ignition systems.

PATCH BOX — The lidded recess in the buttstock of some muzzle loading rifles, in which greased patches were carried, or else the tallow for greasing them as they were used.

PATCH CUTTER — An instrument for pre-cutting bullet patches with the aid of a mallet.

PATCH KNIFE — If you do not use pre-cut patches, each is trimmed at the muzzle during loading with this extremely sharp knife.

PATENT BREECH — Or French breech. One in which the breech plug and nipple seat are cast in one block. This has an up-turned hook on its rear which engages a slot in a separate upper tang. In a half-stock rifle, for example, one barrel key is pulled and the barrel lifts right out, for convenience in cleaning or transporting.

PATINA — The mellow finish that comes with age, on a fine gun or fine furniture. Usually it is a mistake to remove it.

PATTERN — The shot pattern obtained by a shotgun. Generally found by firing at a single spot in the middle of a 30 inch circle at 40 Yards. The percentage of the total shot charge inside the circle is a guide to the degree of choke. Even distribution of the shot is essential. A pattern with large gaps in it is a "blown" pattern. See tips for improvement elsewhere in this book series.

PEPPERBOX — A repeating percussion pistol of the 1840's, with a revolving chambers aligning with a single barrel in turn. Usually small caliber, rifled and double-action.

PERCUSSION — The cap and ball, last type of muzzle loader before the advent of practical breech loaders.

PERCUSSION CAP — A small copper or brass cup-shaped primer, containing a tiny amount of detonating powder such as mercury fulminate. Often foil-lined and waterproofed.

PICK — Or picker. A fine steel wire to clean out a nipple vent or flintlock touchhole.

PICKET BULLET — One of the first conical bullets developed in this country. Only the very base was bore size, tapering forward from there. Extreme care was required in loading to prevent it tipping and losing all accuracy.

PILL LOCK — A very early percussion system. An extremely tiny round pellet of fulminate was used instead of the later metal cap.

PIPES — The short tubes on the underside of a muzzle loader for holding the ramrod.

PISTOL — A firearm to be held in one hand. Thought to derive from Pistoia, an early Italian firearm center.

PITCH — Or twist. The angle or speed of the rifling.

PLAINS RIFLE — With the westward migration, a shorter rifle was needed for loading on horseback, and heavier calibers for buffalo, etc. The famous Hawken rifles were usually half-stock plains rifles.

POWDER FLASK — A container for gunpowder, generally of copper, brass or zinc, typical of the percussion era. Normally has a measuring charger on top.

POWDER HORN — From our colonial period comes the powder container of cow or buffalo horn, more often used with a separate non-adjustable charge measure. Proper accessory with a flintlock.

POWDER MEASURE — A separate accessory with a graduated plunger, useful for experimenting with varying loads in the field.

PRIMER — On some percussion bench rifles, a special attachment permits ignition by a modern primer instead of an ordinary cap.

PRIMING — The finer powder in a flintlock's pan.

PRIMING HORN — A miniature horn for FFFFg priming powder.

PROJECTILE — The ball or bullet shot from a firearm.

PROOF MARKS — Tiny stampings in a barrel's surface, to signify that it has been proof-fired with a prescribed overload under government supervision, as a safety measure.

PROPELLANT, PROPELLENT — Stumbling block of many a writer. The first is the noun, the second is the adjective. Example: For the propellant we use a propellent powder. A "low" explosive suitable for gunpowder.

PULL — The measurement from the firing trigger to the center of the butt plate.

PYRITES LOCK — An improvement over a match-lock, in which iron pyrites fell against a steel frizzen. It had the manually-operated pan cover of the match-lock, and the outside mechanism of the later miquelet.

QUEEN ANNE PISTOL — A flintlock, usually without a fore-end, with a barrel that unscrews to accept the load in the breech end.

RAMROD — The rod, generally of hickory, with which the ball is pushed down the bore against the powder charge.

RE-ENTRY MATCH — One in which the shooter is allowed to fire more than one score for record.

REVOLVER — A handgun with a multi-chambered cylinder and a single barrel.

REVOLVING RIFLE — A rifle with the above type of mechanism. In the nineteenth century, Colt and Remington were leading manufacturers of these arms.

RIB — The strip of steel above the joint between the barrels, in a side-by-side double gun or rifle.

RIFLE — A shoulder firearm designed to fire a single projectile, and with grooves cut in its bore.

RIFLE SAW — A short, file-like cutter at the end of a wooden rod. Drawn through a barrel and mechanically guided in a spiral motion, this cuts the rifling grooves one at a time.

RIFLING — The spiral grooves in a rifle's bore, which improve accuracy by imparting a spin to the projectile.

SALTPETER — Potassium nitrate.

SEAR — The lock part which engages the tumbler and hammer until release by trigger pressure.

SEAR SPRING — The small spring which actuates the sear.

SERPENTINE POWDER — The first crude black gunpowder, before corning was developed. A coarse, non-uniform meal.

SET TRIGGER — A mechanism in which a rear trigger is "cocked" so that a slight touch on the front trigger fires the arm. This eliminates all "creep" or "drag". Switzerland even put them on some issue military rifles.

SHOOTING BENCH — A solid bench for shooting a rifle from a rest.

SHOT DIPPER — A graduated measure on a wooden handle, for measuring one charge of bird shot.

SHOT POUCH OR FLASK — A container, often of leather, for bird shot.

SIDE PLATES — Plates on each side of a patch box cover.

SIGHTING SHOT — A non-scoring shot, at the beginning of a match, to "get the range" dope with wind, adjust sights, etc.

SINGLE-ACTION — A revolver which must be manually cocked for each shot.

SIZING — An additive to certain cloth materials, to give them "body". Must be washed out before using as patching.

SKIN CARTRIDGE — A combustible cartridge for percussion revolvers, encased in nitrated hog's intestine.

SLING — The leather or web strap on a military musket or rifle. Now used as an aid in aiming, but formerly only as a help in carrying the pieces on a long march.

SLING SWIVELS — Two metal loops on a shoulder arm, to which a sling may be attached.

SMOOTH-BORE — Any small-arm or artillery piece, the bore of which is not rifled.

SNAIL — The "water-drain" type of base for a percussion nipple, often seen on higher-grade guns instead of a drum.

SNAPHAUNCE — Similar to its successor, the true flintlock, except that frizzen and pan cover were two separate pieces.

SPANNER — A wrench for cocking a wheellock.

SPERM OIL — Oil from the sperm whale or cachalot. Once a favorite for lamps and for gun oil.

SPOTTING SCOPE — A small telescope, usually 20 power, used for examining the target from the firing point.

SPRING, FLAT OR "KICK" — The original type of spring used in early firearms.

SPRING, HELICAL — A coil spring, not to be confused with a spiral spring.

SPRUE — The small flat on one side of a cast ball, where excess lead was removed by the cut-off plate.

SPUR TRIGGER GUARD — One with a hook on its lower side, to support the second finger and give better control of a hair trigger.

STARTER — A short wooden rod for placing the ball part way down the bore, before using the ramrod.

STEADY PIN — The little knob on the edge of a flat mainspring which fits into a slot in the lock plate.

STIRRUP — The pivoting piece connecting mainspring to tumbler in some locks.

STOCK — The main wooden portion of a firearm, especially a shoulder arm.

STRAIGHT CUT RIFLING — Occasionally an early bore was grooved without any spiral. Now obsolete.

STRIKING A BARREL — The lengthwise, finish draw-filing of a barrel's exterior, especially an octagonal barrel, with a special double-handed striking file.

STRING MEASURE — The pioneer scoring method in which wooden plugs were inserted in each bullet hole, a string drawn around all and measured. The shortest string won. Through the years, there have been several variations of this. Some involving the center and some only measuring group size. Today, "string measure" is done from the center with calipers, and the distances totaled.

SUPERPOSED RIFLES — Double-barreled rifles, one barrel over the other. The barrels of many early ones pivoted upon a longitudinal axis, so that one lock would fire whichever barrel was uppermost.

SWAGING — Putting conical projectiles through a precise die under pressure, to bring them to the exact diameter and shape desired.

TAPE PRIMER — A roll of paper tape containing fulminate pellets at regular intervals. It furnished the ignition for specially-modified rifles, etc., during the Civil War era, on the principle of a toy repeating cap pistol.

TENNON — A slip of metal dovetailed into the bottom of a barrel, through which a barrel key or pin passes, holding the barrel in the stock.

THIMBLE — A "pipe" or short tube for holding the ramrod.

TINDER — A highly flammable substance, such as flax tow or charred linen, used to catch sparks to start a fire. The pioneer used the mechanism of his flintlock to ignite his tinder in camp.

TOE — The corner of the buttstock at the bottom of the butt plate.

TOE PLATE — The metal strip on the bottom of a Kentucky rifle butt, next to the butt plate.

TOMPION — A plug inserted in a gun muzzle during storage, to keep out dirt or moisture. Seldom used today. Do not use wood or other hygroscopic materials.

TOP JAW — The upper half of the clamp which holds a flintlock flint.

TOP JAW SCREW — The heavy screw which clamps the flint in position.

TOUCHHOLE — The vent through which a flintlock pan transmits its flash to the main charge.

TOW — Crude, unspun flax, used in pioneer days like a cleaning patch.

TRAJECTORY — The vertical curve of a bullet's flight.

TRAP — A shotgun contest on aerial targets, usually breakable "clay pigeons". Also the instrument which projects these targets into the air.

TRIGGER — The small lever by which a firearm is fired. Originally "tricker", because it did the trick.

TRIGGER GUARD — The metal bow which guards against accidental trippings of the trigger.

TRIGGER PLATE — A metal strap set into the bottom of the stock, to control lateral motion of the trigger. Sometimes trigger assembly is attached to it, sometimes not.

TRIGGER SPRING — A small spring which returns the trigger to its forward position.

TUBE LOCK — A very early percussion system, developed about 1815, in which the hammer crushed a fulminate-filled copper tube, inserted directly into the vent.

TUBE SIGHT — Ancestor of the telescope sight. A long, thin metal tube, often full length of the barrel, not containing optical lenses. With rear aperture and front pin-head, it allowed maximum definition of the sight picture.

TUMBLER — Central piece of the conventional lock, turning with the hammer. This contains the half-cock and full-cock notches, plus the detent if there is one.

TWIST — The pitch, or angle of spiral of the rifling grooves.

UNDER RIB — A metal rib on the underside of a half-stock's barrel, supporting the ramrod thimbles.

UNDER-STRIKER LOCK — A percussion lock with the hammer underneath, often with the mainspring serving as the trigger guard.

UPPER TANG — An extension of the breech plug, which is held in the small of the stock by a screw.

V-SPRING — A flat V-shaped spring, considered superior to an ordinary single-leaf spring.

VENT — The small aperture of any muzzle loader, through which the flame of ignition reaches the main charge.

VERNIER SIGHT — A precise, adjustable, rear aperture sight, developed in the middle 1800's.

WAD CUTTER — A steel tool for cutting out shotgun wads with a mallet. Also used for the smaller bullet patches.

WHEELLOCK — A more complex mechanism following the matchlock, in which iron pyrites pressed against the serrated edge of a rotating wheel. Ronson still uses the idea.

WINDAGE — A lateral adjustment (or allowance) in sighting.

WIPING ROD — A cleaning rod used during firing, to wipe the bore out between shots.

WORM — A corkscrew tip for a rod, to hold a cleaning patch, or to remove one stuck in the bore.

WRIST — The small of the stock, grasped by the firing hand.

ZERO — The ideal sight setting at a given range, from which adjustments will be made to meet varying conditions of light, wind, etc.

APPENDIX II

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 Christy Gun Works, 857-57th St.,
 Sacramento, Calif. 95832
 Clymer Mfg. Co., 14241 W. 11 Mile Rd.,
 Oak Park, Mich. 48237 (Reamers)
 Dremel Mfg. Co., 2420 28th St., Racine,
 Wis. 53403 (grinders)
 F. K. Elliott, Box 785, Ramona, Calif. 92065
 (reamers)
 Grace Metal Prod., Box 67, Elk Rapids,
 Mich. 49629 (screw drivers, drifts)
 Kasenite Co., Inc., 3 King St., Mahwah, N. J. 07430
 (surface hrdng. comp.)
 Lea Mfg. Co., 238 E. Aurora St.,
 Waterbury, Conn. 06720
 Marker Machine Co., Box 426,
 Charleston, Ill. 61920
 Frank Mittermeier, 3577 E. Tremont, N. Y.,
 N. Y. 10465
 Karl A. Neise, Inc., 5602 Roosevelt Ave.,
 Woodside, N. Y. 11377
 P & C Tool Co., Box 22066, Portland, Oreg. 97222
 P.G.E. Products, 6700 Rowland Ave., Philadelphia, Pa.
 Penn Ind., Box 8904, Philadelphia, Pa. 19135
 (contour gauge)
 Richland Arms Co., 321 W. Adrian St.,
 Blissfield, Mich. 49228
 Roderick Arms & Tool Corp. 110 2nd Street,
 Monett, Mo. 65708
 Schuetzen Gun Works, 1226 Prairie Rd., Colo.
 Springs, Colo. 80909

Shaw's, 1655 S. Euclid Ave., Anaheim, Calif. 92802
 L. S. Starret Co., Athol, Mass. 01331
 T. D.C. Box 42072, Portland, Ore. 97242
 C. Hunt Turner, 618 S. Gore Ave.,
 Webster Groves, Mo. 63119
 Twin City Steel Treating Co., Inc. 1114 S. 3rd,
 Minneapolis, Minn. 55415
 Vanguard Arms Corp., Box 46566, Los Angeles,
 Cal. 90046 (45 single-actions)
 Williams Gun Sight Co., 7389 Lapeer Rd.,
 Davison, Mich. 48423
 Wilson Arms Co., Box 364, Stony Creek,
 Branford, Conn. 06405
 Wilton Tool Corp., 9525 W. Irving Pk. Rd.,
 Schiller Park, Ill. 60176 (vises)
 Woodcraft Supply Corp., 71 Canal St.,
 Boston, Mass. 02114
 Wright Gun & Tool Co., Box 245,
 Bloomsburg, Pa. 17815

HANDGUN ACCESSORIES

John Dangelzer, 3056 Frontier Pl.,
 N. E. Albuquerque, N. M. 87106 (flasks)
 R. S. Frielich, 396 Broome St., New York,
 N. Y. 10013 (grip caps)
 Pachmayr, 1220 S. Grand, Los Angeles, Calif. 90015
 (cases)
 Jules Reiver, 4104 Market St.,
 Wilmington, Del. 29899 (cases)
 Sportsmen's Equipment Co., 415 W. Washington,
 San Diego, Calif. 92103

HANDGUN GRIPS

Sanderson Custom Pistol Stocks, 17695 Fenton,
 Detroit, Mich. 48219
 Southwest Cutlery & Mfg. Co., 1309 Olympic Blvd.,
 Montebello, Calif. 90640
 John W. Womack, 3006 Bibb St., Shreveport, La.

HOLSTERS & LEATHER GOODS

Bianchi Holster Co., 802 So. Primrose Ave.,
 Monrovia, Calif. 91016
 Edward H. Bohlin, 931 N. Highland Ave.,
 Hollywood, Calif. 90038
 Herman H. Heiser Saddlery Co., 1024 Cherokee St.,
 Denver 4, Colo.
 Don Hume, Box 351, Miami, Okla. 74354
 George Lawrence Co., 306 S. W. First Ave.,
 Portland, Ore. 97204
 S. D. Myres Saddle Co., Box 9776, El Paso, Tex. 79988
 Tandy Leather Co., P. O. Box 792, Fort Worth, Texas
 Basil Tuller, 29 Germania St., Galeton, Pa. 16922
 (Protektor Prod.)

HUNTING KNIVES, AXES AND HATCHETS

L. L. Bean, Freeport, Maine 04032
 Buck Knives, Inc., 6588 Federal Blvd.,
 San Diego, Calif. 92114
 W. R. Case Knives, 20 Russell Blvd.,
 Bradford, Pa. 16701
 Gerber Legendary Blades, 14200 S. W. 72nd St.,
 Portland, Ore. 99223
 Morseth Sports Equipment, Clinton, Wash.
 Lee E. Olsen Knife Co., 7 Joy St.,
 Howard City, Mich. 49329
 Randall-Made Knives, Box 1988, Orlando, Fla. 32802
 Ruana Knife Works, Box 574, Bonner, Mont. 59823
 True-Temper, 1623 Euclid, Cleveland, O.

LOAD TESTING & CHRONOGRAPHING

Custom Ballistics Lab., 3354 Cumberland Dr.,
 San Angelo, Tex. 76902
 Hutton Rifle Ranch, Topanga, Calif. 90290
 (daily fee range also)
 Jurras Co., Box 163, Shelbyville, Ind. 46176
 Kennon's, 5408 Biffle, Stone Mountain, Ga. 30083
 R & M Chronograph Serv., 9882 E. Manning,
 Selma, Calif. 93662
 Shooters Service & Dewey, Inc., Clinton Corners,
 N. Y. 12514
 Shooting Assoc. Inc., Stanfordville, N. Y. 12581
 Tyrol Sports Arms Co., 7860 C. Jewell,
 Lakewood, Colo. 80227
 York and Cantrell, 547 Ivanhoe, Ypsilanti, Mich. 48197

METALLIC SIGHTS

B-Square Eng., Box 11281, Ft. Worth, Tex. 76110
 Bo-Mar Tool & Mfg. Co., 59800 North Ave.,
 New Haven, Michigan,
 Maynard P. Buehler, Inc., 17 Orinda Highway,
 Orinda, Calif. 94563
 Burton Arms Co., Box 524, Coshocton, O.
 George Elliason, 2109 Carroll Pl., Tampa, Fla. 33612
 Hi-Lo Sights, P.O. Box 131, Lyndon Station, Wis.
 Lyman Gun Sight Corp., Middlefield, Conn. 06455
 Marble Arms Corp., 1120 Superior,
 Gladstone, Mich. 49837
 Merit Gunsight Co., 6144 Monadnock Way,
 Oakland, Calif. 94605
 Micro Sight Co., 242 Harbor Blvd.,
 Belmont, Calif. 94002
 Original Sight Exchange Co., Box J, Paoli, Pa. 19301
 Redfield Gun Sight Co., 1315 S. Clarkson St.
 Denver, Colo. 80210

Simmons Gun Specialties, Inc., 700 Rodgers Rd.,
Olathe, Kans. 66061

Stokes Eng., 5290 Long Beach Blvd.,
Long Beach, 5, Calif.

Trius Prod., Box 25, Cleves, O. 45002 (bi-ocular)

Williams Gun Sight Co., 7389 Lapeer Rd.,
Davison, Mich. 48423

W. H. Womack, 2124 Meriwether Rd.,
Shreveport, La. 71108

MISCELLANEOUS

Adhesive Flannel, Forest City Prod. 722 Bolivar,
Cleveland, O. 44115

Barrel Bedding, Johnson's, 638 Irvine Dr., Erie 1, Pa.

Bedding Kit, Ann Arbor Arms, 1340 N. Main,
Ann Arbor, Mich.

Bedding Kit, Bisonite Co., Box 84,
Buffalo, N. Y. 14217

Bedding Kit, Resin Div., Fenwal, Inc., 400 Main St.,
Ashland, Mass. 01721

Bore Collimator, Alley Supply Co., Box 458,
Sonora, Calif. 95370

Bore Lamp, Spacetrone, Inc., Box 84,
Broadview, Ill. 60155

Borescope, Eder Inst. Co., 2293 N. Clybourn,
Chicago, Ill. 60614

Borescope, J. G. Mundy, 1008 MacDade Blvd.,
Collingdale, Pa. 19023

Breech Plug Wrench, Swaine Machine, 195 O'Connell,
Providence, R. I. 02905

Bullet Trap, Sterling-Fleischman Inc., Penna. Ave.,
Malvern, Pa. 19355

Chrome Bbl. Lining, Marker Mach. Co., Box 426,
Charleston, Ill. 61920

Chronograph, American Craftsmen,
12645 La Cresta Dr., Los Altos Hills, Calif. 94022

Chronograph, Avtron, 10409 Meech,
Cleveland, O. 44105

Chronograph, B-Square Co., Box 11281,
Ft. Worth, Tex. 76110

Chronograph, Chrondek Electronics, Inc., 2125 D. St.,
La Verne, Calif. 91750

Chronograph, Herter's, Waseca, Minn. 56093

Chronograph, ITCC, 4117 Sherman,
Riverside, Calif. 92303

Chronograph, Micro-Sight Co., 242 Harbor Blvd.,
Belmont, Calif. 94002

Color Hardening, Alamo Heat Treating Co.,
Box 10502, Houston, Tex. 77018

Contour Gauge, Penn. Ind., Box 8904,
Philadelphia, Pa. 19135

Custom Bluing, J. A. Wingert, 124 W. 2nd Street,
Waynesboro, Pa. 17268

Distress Flares, Marsh Coulter Co., Box 333,
Tecumseh, Mich. 49286

Ear-Valv, Sigma Eng. Co., 11320 Burbank Blvd.,
No. Hollywood, Cal. 91601

Epoxy Kit, Ann Arbor Inc., 13400 N. Main,
Ann Arbor, Mich.

Firearm Ident. Service, H. P. White Co., Box 331,
Bel Air, Md. 21014

Folding Cup, Bob Lane Co., Box 333,
Branford, Conn. 06405

Gun Bedding Kit, Resin Div., Fenwal, Inc.,
400 Main St., Ashland, Mass. 01721

Hearing Protector, American Optical Co.,
Southbridge, Mass. 01550

Hearing Protector, David Clark Co., 360 Franklin St.,
Worcester, Mass. 01601

Hearing Protector, Curtis Safety Prod. Co., Box 82,
Webster Sq. Sta., Worcester, Mass.

Hearing Protector, Ray-O-Vac, 212 E. Washington,
Madison, Wis. 53703

Hearing Protector, Sanitizer bath, Graco Pharm. Co.,
172 W. Main St. Meriden, Conn. 06450

Leather Rest-Bags, B. Tuller, 29 Germania,
Galeton, Pa. 16922

Miniature Guns, C. H. Stoppler, 1426 Walton Ave.,
New York, N. Y. 10459

Nipple Wrenches, Chopie Tool & Die Co.,
531 Copeland Ave., La Crosse, Wis. 54603

NRA Targets, Wisler Western Target Co., 205 2nd St.,
San Francisco, Calif. 94105

Powder Flasks, Jewell Powder Flask Co., Central Ave.,
E. Bangor, Pa.

Powder Flash Repair, G. S. Bunch, 7735 Garrison,
Yattsville, Md. 20784

Recoil Pads, Etc., Mershon Co., Inc. 1230 S. Grand,
Los Angeles, Cal. 90025

Recoil Pads, Pachmayr Gun Works, 1220 S. Grand Ave.,
Los Angeles, Calif. 90015

Recoil Pads, Supreme Prod., Box 4261,
Glendale, Calif. 91302

Recoil Reducer, J. B. Edwards, 269 Herbert St.,
Alton, Ill. 62002

Rifle Rests, E. L. Beecher, 2155 Demington Dr.,
Cleveland Hgts., O. 44106

Rifle Rests, The Gun Case, 11035 Maplefield,
El Monte, Cal. 91733

Rifle Rest Sandbags, Jaguar Arms Distr. Inc.,
516 Burnside, E. Hartford, Conn. 06108

RIG, NRA Scoring Plug, Rig Prod. Co., Box 279,
Oregon, Ill. 60262

Salute Cannons, Naval Co., Rt. 611,
Doylestown, Pa. 18901

Shooting Coach, K. R. Groote, 337 Fisher,
Walpole, Mass. 02081

Shooting Coats, 10-X Mfg. Co., 100 S.W. 3rd,
Des Moines, Ia. 50309

Shooting Glasses, M. B. Dinsmore, Box 21,
Wyomissing, Pa. 19610

Shooting Glasses, Mitchell's, Box 539,
Waynesville, Mo. 65583

Shooting Ranges, Shooting Equip. Inc., 4616 W. 20th St.,
Chicago, Ill. 60650

Silver Grip Caps, Bill Dyer, 503 Midwest Bldg.,
Oklahoma City, Okla.

Silver Grip Caps, Katz & Prosser, 18401 Via Jose,
San Lorenzo, Calif.

Springs, W. C. Wolff Co., Box 232,
Ardmore, Pa. 19003

Stick-on Aperture, Glanzer Shooters Supply,
202 S 124th, Seattle, Wash., 98168

Target carrier, Tyrol Sports Arms, 7860 W. Jewell,
Lakewood, Colo. 80227

Target, folding, Gopher Shooters Supply, Box 246,
Faribault, Minn. 55021

Target holder, Product Masters Mfg. Co.,
5013 Aldrich Ave., Minneapolis, Minn. 55430

Target Patches, Time Products Co., 355 Burlington Rd.,
Riverside, Ill. 60546

Target Stamp, Amos, R. D. 1, Telegraph Rd.,
Brownsville, Pa. 15417 (NBRSA-type)

Taxidermy, Jack Atcheson, 2309 Hancock Ave.,
Butte, Mon.

Taxidermy, Jonas Bros., 1037 Broadway,
Denver, Colo. 80203

Taxidermy, Knopp Bros., Spokane, Wash.

Taxidermy, John Schneider, Clifton, New Jersey

Taxidermy, Mac's, 201 N. Grand Ave.,
Waukesha, Wis. 53187

Trophies, Blackinton & Co., 140 Commonwealth,
Attleboro Falls, Mass. 02763

Trophies, F. H. Noble & Co., 535 W. 59th St.,
Chicago, Ill. 60621

PISTOLSMITHS

Alamo Heat Treating, Box 10502, Houston, Tex. 77018

George Elliason, 2109 Carroll Pl., Tampa, Fla. 33612

Larry S. Krause, 5628 Winchester, Chicago, Ill. 60636

Pachmayr Gun Works, 1220 S. Grand Ave.,
Los Angeles, Calif. 90015

REBORING AND RERIFLING

A & M Rifle Co., Box 1713, Prescott, Ariz. 86301

P. O. Ackley, P.O. Box 17347, Salt Lake City,
Utah, 84117

Bain & Davis Sptg. Gds., 559 W. Las Tunas Dr.,
San Gabriel, Calif. 91776

Carpenter's Gun Works, Rt. 32, Plattekill, N. Y. 12568

Fuller Gun Shop, Cooper Landing, Alaska 99572

Ward Koozer, Box 18, Walterville, Oreg. 97489

Les' Gun Shop, Box 511, Kalispell, Mont. 59901

Al Petersen, Riverhurst, Saskatchewan, Canada

Schuetzen Gun Works, 1226 Prairie Rd.,
Colorado Springs, Colo. 80909

Smith's Gun Shop, Box 486, East Tawas, Mich. 48730

Snapp's Gunshop, 214 N. Washington, Royal Oak,
Mich. 48067

R. Southgate, Rt. 2, Franklin, Tenn. 37064

J. W. Van Patten, Box 145, Foster Hill,
Milford, Pa. 18337

Robert G. West, 6626 S. Lincoln, Littleton, Colo. 80120

RELOADING TOOLS AND ACCESSORIES

Alpha-Molykote Corp., 65 Harvard,
Stamford, Conn. 06904

Anchor Alloys, Inc., 966 Meekr Ave.,
Brooklyn, N. Y. 11222 (chilled shot)

Avtron Mfg., Inc., 10409 Meech Ave.,
Cleveland, O. 44105

B-Square Eng. Co., Box 11281, Ft. Worth, Tex. 76110

Belding & Mull, P.O. Box 428, Philipsburg, Pa. 16866

Bonanza Sports, Inc., Rt. 4, Box 246,
Faribault, Minn. 55021

Cascade Cartridge, Inc., Box 660,
Lewiston, Idaho 83501

Container Development Corp., 415 Monroe,
Watertown, Wis. 53094

Cooper Engineering, 612 E. 20th, Houston, Tex. 77008

Cooper-Woodward, Box 972, Riverside, Calif. 92502
(Perfect Lube)

Division Lead Co., 7742 W. 61st Pl., Summit, Ill. 60502

Dom Enterprises, 3985 Lucas, St. Louis, Mo. 63103

Fitz Grips, Box 49797, Los Angeles, Calif. 90049
(Fitz Flipper)

Flambeau Plastics, 802 Lynn, Baraboo, Wis. 53913

The Gun Clinic, 81 Kale St., Mahtomedi, Minn. 55115

H & H Sealants, Box 448, Saugerties, N. Y. (Loctite)

Hensley & Gibbs, Box 10, Murphy, Oreg. 97533

B. E. Hodgdon, Inc., 7710 W. 50 Hiway,
Shawnee Mission, Kans. 66202

Hulme Firearm Serv., Box 83, Millbrae, Calif. 94030

Industrial Prod. Co., Box 14, Bedord, Mass. 01730
(IPCO wads)

JASCO, Box 49751, Los Angeles, Calif. 90049
 Javelina Products, Box 337, San Bernardino, Cal. 92402
 (Alox beeswax)
 Lachmiller Eng., 6445 San Fernando Rd.,
 Glendale, Calif. 91201
 Lee Engineering, Rt. 2, Hartford, Wis. 53027
 Lyman Gun Sight Corp., Middlefield, Conn. 06455
 National Lead Co., Box 831, Perth Amboy, N. J.
 Ohaus Scale Corp., 1050 Commerce Ave.,
 Union, N. J. 07083
 Pacific Gun Sight Co., Box 4495, Lincoln, Neb. 68504
 C. W. Paddock, 1589 Payne Ave., St. Paul, Minn. 55101
 (cartridge boxes)
 Phelps Reloader Inc., Box 4004, E. Orange, N. J. 07019
 Powd-R-Horn, 3802 W. Augusta, Phoenix, Ariz. 85021
 R & K Plastic Industries Co., 3891 W. 150th St.,
 Cleveland, O. 44111
 RCBS, Inc., Box 729, Oroville, Calif. 95965
 Redding-Hunter, Inc., 114 Starr Rd.,
 Cortland, N. Y. 13045
 Rifle Ranch, Rte. 1, Prescott, Ariz. 86301
 Rochester Lead Works, Rochester 8, N. Y. (leadwire)
 Rotex Mfg. Co., 8305 Sovereign Row,
 Dallas, Tex. 75222
 Ruhr-American Corp., So. East Hwy. #55,
 Glenwood, Minn. 56334
 SAECO, 3270 E. Foothill Blvd., Pasadena, Calif.
 Scientific Lubricants Co., 3753 Lawrence Ave.,
 Chicago, Ill. 60625
 Shooters Accessory Supply, Box 250, N. Bend,
 Oreg. 97459 (SAS)
 Star Machine Works, 418 10th Ave.,
 San Diego, Calif. 92101
 Webster Scale Mfg. Co., Box 188, Sebring, Fla. 33870
 Whit's Shooting Stuff, 2121 Stampede Ave., Cody, Wyo.
 L. E. Wilson, Box 324, Cashmere, Wash. 98815

RIFLE BARREL MAKERS

A & M Rifle Co., Box 1713, Prescott, Ariz. 86301
 P.O. Ackley, P.O. Box 17347, Salt Lake City,
 Utah, 84117
 Apex Rifle Co., 7628 San Fernando,
 Sun Valley, Calif. 91352
 Christy Gun Works, 875 57th St.,
 Sacramento, Calif. 95831
 G. R. Douglas, 5504 Big Tyler Rd., Charleston,
 W. Va. 25312
 Wm. H. Hobaugh, Box 657, Philipsburg, Mont. 59858
 Intern'l Gunmakers, 12315 Newburgh Rd.,
 Livonia, Mich. 48150 (Antique)
 Les' Gun Shop, Box 511, Kalispell, Mont. 59902

L. E. Nauman, 1048 S. 5th, Douglas, Wyo. 82633
 Numrich Arms, W. Hurley, N. Y. 12491
 SS & D, Inc., Clinton Corners, N. Y. 12514
 (cold-formed bbls.)
 J. H. Sharon, Box 106, Kalispell, Mont. 59901
 Bliss Titus, Heber, Ut.
 M. G. Watts, 5627 Euclid, Kansas City, Mo. 64130
 Wilson Arms, Box 364, Stony Creek,
 Branford, Conn. 06405

SCOPES, MOUNTS, ACCESSORIES, OPTICAL EQUIPMENT

Bausch & Lomb Optical Co., 635 St. Paul St.,
 Rochester, N. Y. 14602
 Browning Arms, Ogden, Ut.
 Maynard P. Buehler, Inc., 17 Orinda Highway,
 Orinda, Calif. 94563
 D. P. Bushnell & Co., Inc., 639 Bushnell Bldg.,
 Pasadena, Calif. 91107
 Conetrol, Hwy., 123 South, Seguin, Tex. 78155
 Continental Arms Corp., 697 - 5th Ave.,
 New York, N. Y. 10022 (claw mtg. rings)
 Firearms International, 4837 Kerby Hill Rd.,
 Washington, D.C. 20022
 Flaig's, Babcock Blvd., Millvale, Pa. 15209
 Kesselring Gun Shop, Box 350, Rt. 1,
 Burlington, Wash. 98233
 Kuharsky Bros., 2425 W. 12th Street, Erie, Pa.
 T. K. Lee, Box 2123, Birmingham, Ala. 35201
 (reticles)
 E. Leitz, Inc., 468 Park Ave., So.,
 New York, N. Y. 10016
 Leupold & Stevens Instruments, Box 5082,
 Portland, Oreg. 97213
 Marble Arms Co., 1120 Superior St.,
 Gladstone, Mich. 49837
 Marlin Firearms Co., 79 Willow Street,
 New Haven, Conn. 06502
 Numrich Arms, West Hurley, N. Y. 12491
 Original Sight Exchange Co., Box J, Paoli, Pa. 19301
 Pacific Gun Sight Co., Box 4495,
 Lincoln, Neb. 68504
 Premier Reticles, Perry, W. Va. 26844
 Realist, Inc., N. 93 W. 16288, Megal Dr.,
 Menomonee Falls, Wis. 53051
 Redfield Gun Sight Co., 1315 S. Clarkson St.,
 Denver, Colo. 80210
 John Unertl Optical Co., 3551-5 East St.,
 Pittsburgh, Pa. 15214
 W. R. Weaver Co., 7125 Industrial Ave.,
 El Paso, Tex. 79915

TARGETS AND BULLET TRAPS

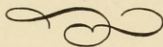
Detroit Bullet Trap Co., 1436 E. Davis,
Arlington Hts., Ill. 60005

National Target Co., 7050 Spring Pl., N. W.,
Washington, D. C. 20012

Product Masters, 5013 N. Aldrich, Minneapolis,
Minn. 55430 (stands)

Sheridan Products, Inc., 1234 13th,
Racine, Wis. 53403 (traps)

X-Ring Prod. Co., Outers Lab., Onalaska, Wis. (traps)



APPENDIX III

BORE, BALL AND BULLET DIMENSIONS

Much confusion exists as to standard bore and bullet or ball size of many of the muzzle loading arms available today. From several sources we've assembled here as much bore/bullet information as we could lay our hands on. Due to manufacturing tolerances, wear, and other factors we can't control, any particular gun may differ somewhat from the values given here. When that happens, some deviation will be required. In general, though, these figures are accurate and correct.



CHART OF ROUND BALL SIZES FOR FLINT & PERCUSSION REPRODUCTION PISTOLS & RIFLES

Gun	Bore Diameter	Ball Diameter
Derringer Philadelphia	.410"	.395"
Dixie Halfstock Rifle	.400"	.395"
Dixie Flint Pistol	.400"	.395"
Dixie Flint Rifle	.400"	.395"
Dixie Percussion Pistol	.400"	.395"
Dixie Percussion Rifle	.400"	.395"
Dixie Target Pistol	.360"	.355"
Door Key Pistol	.373"	.350"
Flint Derringer	.420"	.410"
Harper's Ferry Flint Pistol	.562"	.555"
Hopkins & Allen .36 cal. Pistol	.347"	.340"
Hopkins & Allen .36 cal. Rifle	.347"	.340"
Hopkins & Allen .45 cal. Pistol	.443"	.435"
Hopkins & Allen .45 cal. Rifle	.443"	.435"
Overcoat Pistol	.410"	.400"
Percussion Brass Frame		
Derringer	.410"	.395"
Spanish Percussion Pistol	.410"	.400"
Tower Flint Pistol	.670"	.650"
Zouave, Remington .58 cal.		
Carbine	.580"	.575"
Zouave, Remington .58 cal.		
Rifle	.580"	.575"

BALL SIZES FOR DIXIE RIFLES BARRELED BY DOUGLAS

Caliber	Bore Diameter	Ball Diameter
.32	.321"	.315"
.36	.363"	.355"
.40	.403"	.395"
.45	.451"	.445"
.50	.501"	.495"

BALL SIZES FOR DIXIE BARRELS MADE BY NUMRICH

.36	.347"	.340"
.45	.443"	.435"

DIXIE RIFLE BARREL WITH FITTED BREECH PLUG

.40	.400"	.395"
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CHART OF BALL DIAMETER FOR REPRODUCTIONS REVOLVERS

Make & Model	Chamber Diameter	Ball Diameter
Army, Model 60, .44 caliber	.447"	.451"
Centennial, 1860 Army, .44 caliber	.446"	.450"
Colt, 1861 Navy, .36 caliber	.375"	.380"
Dragoon, .44 caliber	.440"	.441"
Dragoon, Baby, .31 caliber	.316"	.321"
Leech & Rigdon .36 caliber	.371"	.376"
Navy, 1861, .36 caliber	.371"	.376"
Patterson, .36 caliber	.378"	.380"
Reb, .36 caliber	.372"	.376"
Remington Army, .44 caliber	.450"	.454"
Remington Navy, .36 caliber	.371"	.376"
Remington Revolving Carbine .44 caliber	.450"	.454"

CHART OF BALL DIAMETER FOR REPRODUCTIONS REVOLVERS, Continued

Make & Model	Chamber Diameter	Ball Diameter
Replica, 1860 Army, .44 caliber	.446"	.450"
Sheriff's Model, .36 caliber	.372"	.376"
Walker, .44 caliber	.440"	.441"
Wells Fargo, .31 caliber	.315"	.320"
Yank, .36 caliber	.372"	.376"

LEAD BALL SIZES, Continued

Western Size Buckshot	American Size Buckshot	Diameter (caliber)	Number Per Pound
		.66"	16
		.69"	14
		.72"	12
		1.00"	4
		1.67"	1

ROUND BALL WEIGHTS

Caliber	Weight	Caliber	Weight
.20	12.0 gr.	.46	146.0 gr.
.22	16.0 gr.	.48	165.9 gr.
.24	20.7 gr.	.50	187.5 gr.
.26	26.4 gr.	.52	210.9 gr.
.28	33.0 gr.	.54	236.2 gr.
.30	40.5 gr.	.56	263.4 gr.
.32	49.0 gr.	.58	292.6 gr.
.34	59.0 gr.	.60	324.0 gr.
.36	70.0 gr.	.62	357.4 gr.
.38	82.3 gr.	.64	393.2 gr.
.40	96.0 gr.	.66	431.2 gr.
.42	111.0 gr.	.68	471.6 gr.
.44	127.8 gr.	.70	514.4 gr.
.72	559.8 gr.	.82	826.9 gr.
.74	607.8 gr.	.84	888.9 gr.
.76	658.4 gr.	.86	934.0 gr.
.78	711.7 gr.	.88	1022.1 gr.
.80	767.9 gr.	.90	1093.4 gr.

ENGLISH SHOTGUN BORE SIZES

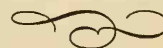
Following is the table of English small arms gauges as given in the Gun Barrel Proof Act of 1868:

Gauge No.	Bore Diameter	Gauge No.	Bore Diameter
A	2.000"	11	.751"
B	1.938"	12	.729"
C	1.875"	13	.710"
D	1.813"	14	.693"
E	1.750"	15	.677"
F	1.688"	16	.662"
1 (one)	1.669"	17	.649"
H	1.625"	18	.637"
J	1.563"	19	.626"
K	1.500"	20	.615"
L	1.438"	21	.605"
M	1.375"	22	.596"
2	1.325"	23	.587"
O	1.313"	24	.579"
P	1.250"	25	.571"
3	1.157"	26	.563"
4	1.052"	27	.556"
5	.976"	28	.550"
6	.919"	29	.543"
7	.873"	30	.537"
8	.835"	31	.531"
9	.803"	32	.526"
10	.775"	33	.520"
34	.515"	43	.476"
35	.510"	44	.473"
36	.506"	45	.469"
37	.501"	46	.466"
38	.497"	47	.463"
39	.492"	48	.459"
40	.488"	49	.456"
41	.484"	50	.453"
42	.480"		

LEAD BALL SIZES

Western Size Buckshot	American Size Buckshot	Diameter (caliber)	Number Per Pound
No. 9	No. 3	.25"	280
No. 8		.26"	263
No. 7½	No. 2	.27"	238
No. 7		.28"	232
No. 6		.29"	186
No. 5	No. 1	.30"	152
No. 4	No. 0	.32"	144
No. 3	No. 00	.34"	128
No. 2	No. 000	.36"	112
No. 1		.38"	96
		.40"	70
		.44"	50
		.45"	48
		.52"	32
		.54"	27
		.57"	24
		.61"	20
		.63"	18

Note that the gauge system goes down only to No. 50, which was until comparatively recent times considered a small bore. Below that the actual bore diameter is used. Gauge sizes shown are reasonably standard throughout the world.



APPENDIX IV

POWDER CHARGE DATA

There are more powder charge recommendations for muzzle loaders than one cares to consider, along with several rules of thumb concocted by various individuals. We can't say that one chart or rule is right and the others are wrong. Actually, they are all pretty much right. Some shooters load conservatively, others love loud noises and large charges of powder. We can say, though, that the charge data given in this appendix is *safe* in guns in good mechanical condition.

We acknowledge that some of the information here conflicts with, or at last differs from, that contained elsewhere in the book. That isn't serious since black powder is a forgiving propellant. You'll eventually want to adjust charges for best results in your particular gun any way, so these are good to start with.

STANDARD MUZZLE LOADING CHARGES

for original guns

Type and Caliber	Ball Diameter	Powder Charge
.69 U.S. Muskets Models 1808-1812-1821-1831-1840-1842	.680"	80 gr. FFG
.69 U.S. Musket Models 1821-1840-1842, rerifled from smooth bore	.680"	75 gr. FFG
.69 Whitneyville Plymouth Navy Rifle	.680"	70 gr. FFG
.58 Remington Zouave	.570" to .575"	60 gr. FFG
.58 U.S. Civil War Rifles Models 1855-61-63	.570" to .575"	60 gr. FFG
.58 U.S. Springfield Pistols Model 1855	.570" to .575"	40 gr. FFG
.58 Fayetteville, Richmond, Cook Bros., Columbus and other Confederate Civil War Muskets	.570" to .575"	60 gr. FFG
.577 English Enfield Rifle	.570" to .575"	60 gr. FFG
.56 Colt Root Rifle	.562"	70 gr. FFG
.54 1804-1814-1817 U.S. Rifles	.535"	75 gr. FFFG
.54 U.S. Mississippi Rifle	.535"	75 gr. FFFG
.54 U.S. Pistol Models 1819-21-26-36-42	.535"	35 gr. FFG

Type and Caliber	Ball Diameter	Powder Charge
.54 Halls Carbine	.535"	85 gr. FFG
.54 Halls Rifle	.535"	100 gr. FFFG
.54 Burnside	.558"	60 gr. FFFG
.54 Gallagher	.535"	55 gr. FFFG
.54 Greene Carbine	.565" to .569"	68 gr. FFFG
.54 Starr	.560"	60 gr. FFFG
.52 Sharp's Carbines & Rifles	.535 to .555"	60 gr. FFFG
.50 Smith Carbine	.515"	50 gr. FFFG
.50 Maynard U.S. Issue	.517"	50 gr. FFFG
.44 Colt Dragoon	.453"	40 gr. FFFG
.44 Colt & Remington Army	.453"	28 gr. FFFG
.44 Modern made Remington and Colt Revolver	.450"	28 gr. FFFG
.44 Modern made Colt Dragoon	.451"	40 gr. FFFG
.41 Dixie brass framed Derringer	.395"	10 gr. FFFG
.40 Dixie Flint & Percussion Rifles	.395"	65 gr. FFFG
.40 Dixie Flint & Percussion Pistols	.395"	25 gr. FFFG
.40 Dixie Half Stock Target Rifle	.395"	55 gr. FFFG
.36 Modern made Remington & Colt Rev.	.376"	22 gr. FFFG
.36 Colt & Remington Navy, Whitney, Pettingill, Savage, Cooper, Bacon and most .36 Revolvers	.376"	22 gr. FFFG
.31 Colt & Remington Pocket Revolver & other .31 American Revolvers	.321"	15 gr. FFFG
Pepperboxes—no standard caliber	.30" to .38"	15 gr. to 20 gr.

Powder Charge Rules

KENTUCKY RIFLES: One Grain weight of powder for each caliber, i.e.: .41 caliber rifle will use about 41 grains of black powder.

SINGLE SHOT PISTOLS: For most accurate shooting, use the lightest load possible and still get the ball to the target without a big drop in trajectory.

PERCUSSION RIFLES: Same directions as the single shot pistol.

BELGIAN SHOTGUN PROOF CHARGES

Every Belgian percussion shotgun goes through a thorough proof testing. In addition the barrel is stamped underneath with the true size in millimeters. On a double this is sometimes different on left and right barrels. This number is normally about 1½ inches from the breech on the underside of the barrel. This chart

shows the gauge of the gun, which is not marked on the barrel, and the diameter in millimeters. Also shown is the Belgian proof charge using black powder and one lead ball that is 6/10ths millimeters less in diameter than the bore. Do not attempt to use these loads in hand-held firearms!

Gauge	Size In Millimeters	Black Powder Proof Charge In Grams	Weight Of Lead Ball In Grams
1	35.0	156	236
	34.0	143	223
2	33.0	131	195
	32.0	119	177
	31.0	108	163
	30.0	98	148
3	29.0	88	132
	28.0	80	120
	27.0	71	110
4	26.0	64	96
	25.0	56	86
	24.0	50	74
	23.8	48	72
5	23.6	47	70
	23.4	45	68
	23.2	44	66
	23.0	43	64
	22.8	42	62
	22.6	41	60
	22.4	40	58
6	22.2	38	56
	22.0	37	55
	21.8	36	54
	21.6	35	53
	21.4	34	52
	21.2	33	50
	21.0	32	49
7	20.8	31	47
	20.6	29	45
	20.4	27	44
	20.2	27	43
	20.0	27	42
	19.8	27	40
	19.6	24	39
8	19.4	24	38
	19.2	24	37
	19.0	23	35
	18.8	23	34
9	18.6	23	33
	18.4	20	32
	18.2	20	31
10	18.0	20	30
	17.8	20	29

Gauge	Size In Millimeters	Black Powder Proof Charge In Grams	Weight Of Lead Ball In Grams
14	17.6	17	28
	17.4	17	27
15	17.2	17	26
	17.0	17	25
16	16.8	15	24
	16.6	15	23
17	16.4	15	23
	16.2	15	22
18	16.0	13.5	21
	15.8	13.5	20
19	15.6	13.5	19
	15.4	12	18.5
20	15.2	12	18
	15.0	12	17
21	14.8	10.5	16.5
	14.6	10.5	16
22	14.4	10.5	15
	14.2	9	14.5
23	14.0	9	14
	13.8	9	13.5
24	13.6	9	13
	13.4	8	12
25	13.2	8	11.5
	13.0	7	11
26	12.8	7	10.5
	12.6	7	10
27	12.4	7	9.5
	12.2	6	9.5
28	12.0	6	8.5
	11.8	6	8.5
29	11.6	5	7.5
	11.4	5	7
30	11.2	5	6.8
	11.0	4	6.5
31	10.8	4	6
	10.6	4	5.5
	10.4	4	5.5
	10.2	4	5
32	10.0	4	5

CAUTION: The above charges are for *PROOF* Loads only. Do not attempt to use them for hand-held shooting.

SHOTGUN LOADS*Convert Drams to Grains from Weight Tables*

	Drams Powder	Oz. Shot	Type Load
4 Ga.	8-10	3	Medium
10 Ga.	5	1¾	Heavy
10 Ga.	4½	1½	Medium
10 Ga.	4	1½	Light
12 Ga.	4½	1¾	Heavy
12 Ga.	3¾	1¼	Medium
12 Ga.	3¼	1⅛	Light
16 Ga.	3⅛	1⅛	Heavy
16 Ga.	3	1	Medium
16 Ga.	2½	1	Light
20 Ga.	2¾	1	Heavy
20 Ga.	2⅝	1	Medium
20 Ga.	2	¾	Light
28 Ga.	2	⅝	Medium
32 Ga.	1¾	½	Medium
410 Ga.	1½	½	Medium

**BRITISH SERVICE LOADS FOR MUZZLE
LOADING GUNS**

Established in 1896 by the Gunmakers Company and the Guardians of the Birmingham Proof House under the authority of the Gun Barrel Proof Act, 1868.

Gauge	Powder		Ball Grains	Shot Ozs.
	Grains	Drams		
4	273	10	1531	3½
5	213	7 ²⁵ / ₃₂	1217	2 ²⁵ / ₃₂
6	179	6 ¹⁷ / ₃₂	1025	2 ¹⁷ / ₃₂
7	154	5¾	889	2 ³ / ₃₂
8	135	4 ¹³ / ₁₆	793	1 ⁹ / ₁₆
9	122	4 ¹⁵ / ₃₂	725	1 ²⁵ / ₃₂
10	109	4	656	1½
11	96	3½	574	1¾
12-13	89	3¼	547	1¼
14-15	82	3	492	1⅞
16-18	75	2¾	437	1
19-21	68	2½	383	¾
22-30	55	2	328	¾
31-40	41	1½	246	¾
41-50	27	1	164	¾

WEIGHT MARKINGS OF FLASKS

Whether a flask is for a pistol, rifle or fowling piece, can be determined by its size and by the markings on the chargers. Some, but not all adjustable chargers have numerical markings at the different positions.

American or English flasks are marked in Drams, except for Colt who used grains avoirdupois. European flasks are marked in grains apothecaries weight.

Black powder is sold by avoirdupois weight; 16 ounces or 7,000 grains to the pound. A pound contains 256 drams.

Apothecaries weight is 12 ounces to the pound and contains 5,760 grains.

Dixon flasks measure the dram at 27½ grains apothecaries weight.

The following table of converting drams to grains avoirdupois in round numbers may be helpful.

1	Dram equals 27½ grains
1¼	Drams equals 34 grains
1½	Drams equals 41 grains
1¾	Drams equals 48 grains
2	Drams equals 55 grains
2¼	Drams equals 61 grains
2½	Drams equals 68 grains
2¾	Drams equals 75 grains
3	Drams equals 82 grains
3¼	Drams equals 89 grains
3½	Drams equals 96 grains
3¾	Drams equals 102 grains
4	Drams equals 109 grains

GRANULATION SIZES OF BLACK POWDER

Granulation	Passes Opening	Not Pass
FG	.0689"	.0582"
FFG	.0582"	.0376"
FFFFG	.0376"	.0170"
FFFFFG	.0170"	.0111"



APPENDIX V

BLACK POWDER VELOCITIES

Many factors influence the velocities of muzzle loading guns besides the mere ratio of weights of powder to lead. Patched round balls are the most common projectiles. From tests that have been conducted with modern black powder in guns of conventional design, the data in the table to follow has been generated. Obviously, conical bullets and other deviations will invalidate the table. Also, pistols, shotguns and slug rifles obtain quite different velocities than patched ball rifles, and must be treated separately.

Any factor which alters breech pressure has a direct influence on muzzle velocity as well. Such considerations as fit of the ball, tightness after patching, roughness of the bore, whether the bore is clean or dry, fouled or oiled—all have measurable effects on velocity. Another important one is efficiency of ignition, and some foreign percussion caps are much hotter than any manufactured in this country.

American black powder of today is far more uniform than that of Civil War days, thus, velocities will be consistent if all other factors are kept reasonably uniform.

The following chart indicates velocities produced by various ratios of bullet to powder weight.

Ball weight	Powder weight	Velocity
1	1	2570 fps
1½	1	2325 fps
2	1	2135 fps
2½	1	1975 fps
3	1	1850 fps
3½	1	1750 fps
4	1	1670 fps
4½	1	1600 fps
5	1	1535 fps
5½	1	1480 fps
6	1	1425 fps
6½	1	1375 fps
7	1	1325 fps
7½	1	1280 fps
8	1	1235 fps

Ball weight	Powder weight	Velocity
8½	1	1200 fps
9	1	1155 fps
9½	1	1120 fps
10	1	1035 fps

The following velocities and corresponding energies for the cal .69 flintlock musket (smoothbore) and cal. .58 percussion rifle were the results of U. S. Army tests of the mid-19th Century. Velocities of comparable guns and loads may be estimated with reasonable accuracy from these values.

Cal.	Powder	Bullet	Velocity	Energy
.69	110 grs.*	412-gr. rd. ball	1500 fps	2060 fp
.58	60 grs.	510-gr. Minie	963 fps	1050 fp

*Including priming. A lighter charge is required in present-day black-powders.

Extensive velocity measurements were made with ballistic pendulums by Capt. Alfred Mordecai of the Ordnance Department and given in his "Report Of Experiments On Gunpowder Made At Washington Arsenal In 1843 And 1844." The averages shown in the following chart were tabulated by him as typical velocities. The corresponding energies have been computed and added. A5 rifle powder and 219-gr. round balls of 32 to the pound were used throughout.

For the cadet's musket the balls were wrapped in cartridge paper and for the common rifle in greased patches. The Hall's and Jenk's arms were shot breech-loaded, with the balls naked. Capt. Mordecai commented that the velocity loss from the leaking joint of the Hall's breech was serious. Among incidental findings of the small arms portion of these tests was the importance of effective wadding or patching to attainment of full velocity.

Arm	Bore dia.	Bbl. length	Powder	Velocity	Energy
1. Cadet's musket, old pattern (flintlock Common rifle)	.57"	35.5"	70 gr.	1690 fps	1390 fp
2. 1841 (percussion)	.54"	32.5"	100 gr.	2018 fps	1980 fp
3. Same			70 gr.	1755 fps	1500 fp
4. Hall's rifle, 1826 (flintlock breech loader)	.52"	35.1"	70 gr.	1490 fps	1080 fp
5. Hall's carbine, 1840 (percussion breech loader)	5.25"	23.38"	70 gr.	1240 fps	750 fp
6. Jenk's Carbine 1844 (percussion breech loader)	.52"	24.25"	70 gr.	1687 fps	1385 fp

A .45 caliber (.451") flintlock rifle of new manufacture has been chronographed. The 135 grain round ball was shot with a greased patch in a 44" barrel. The charge of FFFg black powder shown gave the following velocities. Striking energies at muzzle have been computed and added. FFFG granulation duPont powder was used throughout.

Charge	Velocity	Energy
30 gr.	1180 fps	420 fp
40 gr.	1560 fps	730 fp
50 gr.	1700 fps	865 fp
60 gr.	1800 fps	970 fp
70 gr.	1940 fps	1130 fp
90 gr.	2100 fps	1325 fp
100 gr.	2140 fps	1375 fp

The following table gives the velocities and corresponding energies of round balls of approximate size suitable for firing with a patch from cylinder bores of the gauges shown. These combinations are the ones in which standard shot charges are approximated by the weights of round ball. The velocities are of standard shotgun loads, with small corrections where weights of shot charges and round balls are not exactly the same.

Gauge	Std. bore dia.	Undersize ball	Powder	Velocity	Energy
10	.775"	670 gr.	130 gr.	1370 fps	2790 fp
12	.729"	560 gr.	102 gr.	1330 fps	2200 fp
16	.662"	420 gr.	68 gr.	1225 fps	1400 fp
20	.615"	335 gr.	61 gr.	1275 fps	1210 fp

PISTOL VELOCITY

A .40 caliber Dixie percussion pistol with 9" barrel has been chronographed with the following results. FFFG and cloth-patched round ball were used.

Powder	Velocity	Maximum Variation
20 gr.	816 fps	49 fps
30 gr.	872 fps	86 fps
35 gr.	1145 fps	110 fps
40 gr.	1178 fps	50 fps

A .40 caliber Dixie percussion rifle was tested extensively on modern chronograph equipment. Patched round balls of proper diameter were used. Beginning with the barrel 40" in length, 5-shot strings were fired with the charges shown across the top of the following chart. The barrel was then shortened 2" and the test was repeated. The barrel was successively shortened

in 2" steps until at 20" muzzle blast became objectionable and the tests were terminated. The heavier charges were eliminated in the shorter barrel lengths for the same reason.

The results are charted below. Read right from barrel length, then down from powder charge. Velocity is shown where the two columns intersect.

Charge Weights in Grains of duPont FFFg

Barrel Length	38	47	56	65	75	84	94	104	114	120
40"	1551	1770	1884	1987	2059	2178	2260	2356	2437	2463
38"	1567	1747	1879	1992	2099	2216	2306	2347	2359	2398
36"	1543	1735	1836	1994	2079	2189	2194	2301	2274	
34"	1493	1610	1828	1966	2063	2186	2272	2246		
32"	1527	1654	1819	1913	2017	2098	2199	2233		
30"	1460	1642	1796	1932	1984	2052	2088	2064		
28"	1492	1623	1742	1903	1973	2095	2089			
26"	1445	1596	1734	1838	1902	1944	1952			
24"	1449	1593	1710	1784	1894	2019	2092			
22"	1468	1553	1668	1733	1844	1879	1937			
20"	1420	1509	1631	1703	1818	1863	1976			



APPENDIX VI

MISCELLANEOUS MUZZLE LOADING INFORMATION MUZZLE LOADING DON'TS

Don't shoot an old gun until it has been disassembled, examined, and found safe. That is, the breech plug must be tight, the drum tight and the nipple tight and clear. The barrel must be free and clean. For any accuracy at all, it probably will need to be freshed out or re-rifled.

Don't shoot any piece until it has been proved safe by proper proof testing.

Don't prime the pan of a flinter or cap a percussion arm until the arm is pointed at the target which you intend to shoot.

Don't smoke while handling black powder.

Don't hurry, on a misfire, to examine the piece until sufficient time has elapsed to be reasonably assured that a latent spark is not active.

Don't pour powder direct from the flask or horn into a just fired barrel—wipe it first, then use a measure.

Don't engage a target shooter in conversation when he is firing for record or while he is loading.

Don't handle the equipment of others without specific permission.

Don't as a matter of curiosity, tinker or fool with another's sights at any time.

Don't allow a powder horn to remain in the sun for extended periods. It is liable to crack and split.

Don't place your finger in the muzzle of a barrel while examining the piece. Perspiration contains acids and salts which cause rust to form rapidly.

Don't buy an old gun, especially if the price is substantial, until it has been dismantled to permit an examination of its interior.

Don't buy a gun without a receipt stating the piece is authentic and is as represented to be.

Don't use smokeless powder in any amount in black powder guns.

Don't prime the clean-out or nipple hole to expel a bullet when the main powder charge has not been poured into the barrel without first ramming the ball flush against the priming load. If the priming charge does not expel the bullet, reprime with sufficient FFFFG. The first firing will have moved the ball up the barrel some unknown distance, thus permitting a sufficient

additional priming charge to be inserted thru the clean-out hole. BUT, this time ram the ball back against the powder before firing.

A brand new rifle of modern steel components blew up at the Friendship Shoot 1959, because of the failure of its operator to heed advice akin to the foregoing.

Don't shoot any piece until you've ascertained there is no foreign matter in the barrel.

Don't believe the old Kentucky which belonged to Great Grandad drove a tack at any range every shot. Grandad was lucky if it drove *one* tack from the rest position at 25 yards.

Don't believe the saying "They don't put the stuff into them today that they did years ago." Actually the steels available to the old gun makers were of unknown and unascertainable quality and analysis. Steel making techniques had not then advanced to the point that impurities were removed nor could quality be controlled. For a detailed account of this premise, see American Rifleman of December 1959.

Don't assume an old gun is unloaded—check it—many of them are loaded.

Don't point any gun, even though you know positively it is unloaded, at anything you don't intend to shoot. This is the cardinal rule for safety in gun handling—*NO* exceptions to this rule.

Don't store any gun for any period of time in a case, particularly a sheep lined case, unless accompanied by VPI crystals or paper.

Don't store your guns in a basement. All basements when artificial heat is absent are damp. If you must so store your guns, wipe them inside and out at frequent intervals.

Don't store your mold or swage without a bullet in it generously oiled.

Don't store or carry your gun in an unlined canvas case if you value the finish on it. Canvas will deface finishes.

Don't permit your rifle or pistol to remain in the hot sun between relays or from one relay to a later one. The barrel will heat unevenly from the sun's rays thus causing non-uniform expansion which in turn will cause

inconsistent points of impact on the target. When it is not in use, store it in the shade or cover with a canvas or blanket.

Don't bend your body over the muzzle when ramming a bullet into a charged barrel.

Don't pour powder into a barrel which has been oiled for storage. Clean it first with a patch or two, then snap a cap to burn oil out of tube, then load for shooting.

Don't get careless at any point in the procedures of

muzzle loading shooting.

Don't drink intoxicants if you intend to shoot and don't shoot if you have been drinking. No booze or no shooting.

There is considerable interest in muzzle-loading artillery. While most of the shooting done these days is with new-production replica or look-alike guns, information on Civil-War period guns is always of interest. Having it at hand, we can compare the results of modern cannon-shoots.

Listed below are the essential characteristics of the more widely-used Civil War artillery pieces.

FIELD ARTILLERY OF THE CIVIL WAR

	Bore Diam.	Material	Length of tube	Weight of tube	Weight of projectile	Powder Charge	Range at 5 degree elev.
6 Pounder	3.65"	bronze	60"	884 lbs.	6.10 lbs.	1.25 lbs.	1,523 yds.
6 pdr. Wiard	2.56"	steel	56"	600 lbs.	6.00 lbs.	0.60 lbs.	1,800 yds.
6 pdr. Whitworth	2.15"	steel	70"	700 lbs.	6.00 lbs.	1.00 lbs.	2,750 yds.
10 pdr. Par.	3.00"	iron	74"	890 lbs.	9.50 lbs.	1.00 lbs.	1,850 yds.
10 pdr. Wiard	3.00"	steel	58"	790 lbs.	10.00 lbs.	1.00 lbs.	1,850 yds.
12 pdr. gun	4.62"	bronze	78"	1757 lbs.	12.30 lbs.	2.50 lbs.	1,663 yds.
12 pdr. How.	4.62"	bronze	53"	788 lbs.	8.90 lbs.	1.00 lbs.	1,072 yds.
12 pdr. Blakeley	3.40"	steel	59"	800 lbs.	10.00 lbs.	1.00 lbs.	1,850 yds.
12 pdr. James	3.67"	bronze	60"	875 lbs.	12.00 lbs.	0.75 lbs.	1,700 yds.
12 pdr. Nap. rifles	4.62"	bronze	66"	1227 lbs.	12.30 lbs.	2.50 lbs.	1,619 yds.
12 pdr. Whitworth	2.75"	steel	104"	1092 lbs.	12.00 lbs.	1.75 lbs.	2,800 yds.
12 pdr. Whitworth	2.72"	steel	84"	1000 lbs.	12.00 lbs.	2.00 lbs.	3,000 yds.
20 pdr. Parr.	3.67"	iron	84"	1750 lbs.	20.00 lbs.	2.00 lbs.	1,900 yds.
24 pdr. How.	5.90"	bronze	65"	1318 lbs.	18.40 lbs.	2.00 lbs.	1,322 yds.
24 pdr. James	4.62"	bronze	78"	1750 lbs.	24.00 lbs.	1.50 lbs.	1,800 yds.
32 pdr. How.	6.40"	bronze	75"	1920 lbs.	25.60 lbs.	2.50 lbs.	1,504 yds.
3" Armstrong	3.00"	steel	76"	996 lbs.	12.00 lbs.	1.25 lbs.	2,200 yds.
3" Armstrong	3.00"	steel	83"	918 lbs.	12.00 lbs.	1.25 lbs.	2,100 yds.
3" Ord.	3.00"	iron	69"	816 lbs.	9.50 lbs.	1.00 lbs.	1,830 yds.
Pdr.—Pounder How.—Howitzer							Nap.—Napoleon Parr.—Parrot

When planning to build or have built a new rifle, calculating its weight can be a bit of a problem. The major proportion of the weight is concentrated in the barrel, and you can't weigh the barrel until it's at hand. Barrel weight needs to be known *before* ordering. By

use of the tables below, the weight of a given length, size, and caliber barrel can easily be determined. Or, on the other hand, a barrel can be selected to suit a previously-chosen weight.

WEIGHTS OF 43" OCTAGON BARRELS MEASURED ACROSS THE FLATS

Cal.	13/16"	7/8"	15/16"	1"	1-1/8"
.32	6-2/16 lbs.	6-12/16 lbs.	7-14/16 lbs.	9-8/16 lbs.	12 lbs.
.36	5-8/16 lbs.	6-8/16 lbs.	7-5/16 lbs.	9-3/16 lbs.	11-8/16 lbs.
.40	5 lbs.	6-5/16 lbs.	7 lbs.	8-9/16 lbs.	11-3/16 lbs.
.45	4-13/16 lbs.	5-12/16 lbs.	6-8/16 lbs.	8-4/16 lbs.	10-14/16 lbs.
.50	4-4/16 lbs.	5-4/16 lbs.	6-3/16 lbs.	7-10/16 lbs.	10-5/16 lbs.

**WEIGHTS IN OUNCES
PER INCH OF OCTAGON BARRELS
MEASURED ACROSS THE FLATS**

Cal.	7/8	15/16	1"	1-1/16	1-1/8
.22	2.7	3.2	3.6	4.1	4.5
.24	2.7	3.2	3.6	4.0	4.5
.26	2.6	3.1	3.6	4.0	4.5
.28	2.6	3.1	3.5	4.0	4.4
.30	2.6	3.1	3.5	4.0	4.4
.32	2.5	3.0	3.4	3.9	4.4
.34	2.5	2.9	3.4	3.9	4.4
.36	2.4	2.9	3.4	3.9	4.4
.38	2.4	2.8	3.3	3.8	4.3
.40	2.3	2.8	3.2	3.8	4.3
.42	2.3	2.7	3.2	3.7	4.3
.44	2.2	2.7	3.1	3.7	4.2
.46	2.1	2.6	3.1	3.6	4.2
.48	2.0	2.5	3.0	3.5	4.1
.50	2.0	2.4	2.9	3.4	4.1
.52	1.8	2.3	2.8	3.4	4.0
.54	—	2.3	2.7	3.3	3.9
.56	—	2.1	2.7	3.3	3.8
.58	—	2.0	2.6	3.1	3.7
.60	—	1.9	2.5	3.1	3.6
.62	—	1.8	2.4	2.9	3.5

Screw hole threads are often stripped or rusted out and must be recut to place the gun in good shooting condition. The tap sizes shown are suitable for freshening-out or recutting threads for the screw sizes listed opposite. The fit is not always perfect, but acceptable new threads can be cut, and matching screws are readily available.

- 3/16 x 24 tap: No. 2, 4, 7D, 55 and 54 screws.
- 10 x 24 tap: No. 1 screw.
- 6 x 40 tap: No. 24, 27, 60, 68, 66, 27, 24R, 83 and 85.
- 8 x 36 tap: No. 3, 23, 25, 26 and 84.
- 8 x 32 tap: No. 22, 58, 57P, 58P, 59 and 57.
- 12 x 24 tap: No. 34, 66, and 63.
- 10 x 32 tap: No. 82.
- 12 x 28 tap: No. 88 and Gate catch screw.

Percussion cap can be a bit of a problem to fit correctly on a nipple. The sizes are not entirely standardized. Modern nipples generally measure .163" tapered to .168", plus-or-minus .002", from top to bottom. The .167-8" caps will be a snug fit on some nipples; others will fit only by forcing. If the cap that you are using must be forced on your nipples, grind or polish the neck of the nipple to reduce the diameter and allow the cap to fit better. The dimensions given below are averages, and are sufficient to show why a perfect fit isn't always obtained.

	Inside Diameter	Length
No. 10 Alcan	.167"	.178"
No. 11 Italian	.168"	.153"
No. 1075 German	.170"	.170"
Eley No. F4-12	.170"	—
No. 1055 German	.170"	.220"
No. 11 Remington	.170"	.190"
No. 11 Belgium (Dixie)	.172"	.206"
Eley No. F4-21	.175"	—
No. 11 Winchester	.175"	.200"
Eley No. F4-25	.177"	—
No. 12 Alcan	.178"	.195"
No. 12 Remington	.178"	.190"

Handloaders know that some makes and models of primers produce greater velocity than others, all other factors being equal. The same is true, to a degree, with percussion caps. This is confirmed by the results of test firing tabulated below.

	Dixie Caps	German Caps	Italian Caps	Remington Caps
No. of shots	17	20	13	10
Lowest Velocity	2024	2041	1992	1976
Highest Velocity	2091	2100	2074	2128
Maximum Variation	67FPS	59FPS	82FPS	152FPS
Average Velocity	2062	2066	2035	2086



APPENDIX VII

TABLES

This appendix has been set up as a sort of potpourri of miscellaneous useful information that didn't seem to fit in any particular previous chapter. There isn't much more to be said about it except that the follow-

ing information is too valuable to leave out.

Since black powder shooters are always on the make for original arms for either show or shooting, the condition standards listed below may be useful.

CONDITION STANDARDS FOR ANTIQUE FIREARMS

FACTORY NEW — All original parts; 100% original finish; in perfect condition in every respect, inside and out.

EXCELLENT — All original parts; over 80% original finish; sharp lettering, numerals and design on metal and wood; unmarred wood; fine bore.

FINE — All original parts; over 30% original finish; sharp lettering, numerals and design on metal and wood; minor marks in wood; good bore.

VERY GOOD — All original parts; none to 30% original finish; original metal surfaces smooth with all edges sharp; clear lettering, numerals and design on metal; wood slightly scratched or bruised; bore condition disregarded for collectors firearms.

GOOD — Some minor replacement parts; metal smoothly rusted or lightly pitted in places, cleaned or reblued; principal lettering, numerals and design on metal legible; wood refinished, scratches, bruises or minor cracks repaired; in good working order.

FAIR — Some major parts replaced; minor replacement parts may be required; metal rusted, may be lightly pitted all over, vigorously cleaned or reblued; rounded edges of metal and wood; principal lettering, numerals and design on metal partly obliterated; wood scratched, bruised, cracked or repaired where broken; in fair working order or can be easily repaired and placed in working order.

POOR — Major and minor parts replaced; major replacement parts required and extensive restoration needed; metal deeply pitted, principal lettering, numerals and design obliterated, wood badly scratched, bruised, cracked or broken; mechanically inoperative; generally undesirable as a collectors firearm.

It's often convenient to know how much energy your bullet is developing as it leaves the muzzle. When velocity and bullet weight are known, this is easily computed, but the table below is more simply used. Having determined the velocity from Appendix 5, or from your own tests, simply lay a straightedge across the table under the correct velocity reading. Opposite will be seen the energy *per grain of weight* for any bullet. Simply multiply this figure by the bullet weight in grains to get energy in foot-pounds.

For example, you're shooting a 100 grain ball at 1850 fps. Read off 1850 in the left column and opposite you'll see the value 7.60. Multiply 7.60 by bullet weight, 100, and the result is 760 fp. This is the energy of that bullet at the muzzle.

TABLE OF BULLET ENERGY

Velocity in fps	Energy Per Grain of Bullet Weight	Velocity in fps	Energy Per Grain of Bullet Weight
600	.80	640	.91
610	.82	650	.94
620	.85	660	.96
630	.88	670	.99
680	1.02	930	1.92
690	1.05	940	1.96
700	1.08	950	2.00
710	1.11	960	2.04
720	1.15	970	2.08
730	1.18	980	2.13
740	1.21	990	2.17
750	1.24	1000	2.22
760	1.28	1010	2.26
770	1.31	1020	2.31
780	1.34	1030	2.35
790	1.38	1040	2.40
800	1.42	1050	2.45
810	1.45	1060	2.49
820	1.49	1070	2.54
830	1.53	1080	2.59
840	1.56	1090	2.63
850	1.60	1100	2.68
860	1.64	1110	2.73
870	1.68	1120	2.78
880	1.72	1130	2.83
890	1.76	1140	2.88
900	1.79	1150	2.93
910	1.83	1160	2.99
920	1.87	1170	3.04
1180	3.09	1460	4.73
1190	3.14	1470	4.79
1200	3.19	1480	4.86
1210	3.25	1490	4.93
1220	3.30	1500	5.00
1230	3.36	1510	5.06
1240	3.41	1520	5.13
1250	3.47	1530	5.19
1260	3.52	1540	5.26

Velocity in fps	Energy Per Grain of Bullet Weight	Velocity in fps	Energy Per Grain of Bullet Weight
1270	3.58	1550	5.33
1280	3.63	1560	5.40
1290	3.69	1570	5.47
1300	3.75	1580	5.54
1310	3.81	1590	5.61
1320	3.86	1600	5.68
1330	3.92	1610	5.75
1340	3.98	1620	5.82
1350	4.40	1630	5.90
1360	4.10	1640	5.97
1370	4.16	1650	6.04
1380	4.22	1660	6.12
1390	4.29	1670	6.19
1400	4.35	1680	6.26
1410	4.41	1690	6.34
1420	4.47	1700	6.41
1430	4.54	1710	6.49
1440	4.60	1720	6.57
1450	4.66	1730	6.64
1740	6.72	1990	8.79
1750	6.80	2000	8.88
1760	6.88	2010	8.97
1770	6.95	2020	9.06
1780	7.03	2030	9.15
1790	7.11	2040	9.24
1800	7.19	2050	9.33
1810	7.27	2060	9.42
1820	7.35	2070	9.50
1830	7.43	2080	9.60
1840	7.51	2090	9.70
1850	7.60	2100	9.80
1860	7.68	2110	9.90
1870	7.76	2120	9.98
1880	7.84	2130	10.07
1890	7.93	2140	10.17
1900	8.01	2150	10.26
1910	8.10	2160	10.36
1920	8.18	2170	10.45
1930	8.35	2180	10.55
1940	8.37	2190	10.65
1950	8.44	2200	10.74
1960	8.53	2210	10.84
1970	8.61	2220	10.94
1980	8.70	2230	11.04
2240	11.14	2420	13.00
2250	11.24	2430	13.11
2260	11.34	2440	13.22
2270	11.44	2450	13.33
2280	11.54	2460	13.44
2290	11.64	2470	13.55
2300	11.74	2480	13.66
2310	11.83	2490	13.77
2320	11.95	2500	13.88
2330	12.05	2510	13.99
2340	12.16	2520	14.10

TABLE OF BULLET ENERGY, Continued

Velocity in fps	Energy Per Grain of Bullet Weight	Velocity in fps	Energy Per Grain of Bullet Weight
2350	12.26	2530	14.20
2360	12.37	2540	14.32
2370	12.47	2550	14.44
2380	12.58	2560	14.55
2390	12.68	2570	14.67
2400	12.78	2580	14.78
2410	12.90	2590	14.89
		2600	15.01

HOW TO LOAD BLANK SHOTSHELLS

Black powder is used in factory loaded blank shotshells, and should be used in handloaded blanks. FFG granulation is recommended.

Either paper, plastic, or brass shells may be used.

The inside diameter of brass shells is greater than that of paper shells, requiring special over-size wads which are readily available. Brass cases should be scrubbed in soapy water with a bristle brush immediately after firing to remove residue which will eventually corrode them. Paper or plastic cases must be resized, just as for shot loadings.

10 gauge shells are loaded with 6 to 8 drams of powder, 12 gauge with 6 drams, 16 gauge with about 4 drams, and 20 gauge with about 3 drams. Smaller charges work equally well if the report is loud enough to suit you.

It is essential that you use an extra heavy wad over the powder. Place a nitro card over the powder, then use commercial wads or newspaper carefully packed in tightly to fill the case, leaving just enough room for a solid crimp.

Keep in mind that the wads constitute a substantial projectile. At close range they are nearly as dangerous as a bullet. Don't under any circumstances fire a blank directly at a person or animal.



APPENDIX VIII

BOOKS for the MUZZLE LOADER PAMPHLETS & BOOKLETS for the MUZZLE LOADER PERIODICALS for the MUZZLE LOADER

BOOKS FOR THE MUZZLE LOADER

BALLISTICS

THE BULLET'S FLIGHT, from Powder to Target, by F. W. Mann. Ray Riling Arms Books Co., Phila., Pa. 1965. A reprint of the very scarce original work of 1909. Introduction by Homer S. Powley, 384 pp. illus. \$9.95.

One of the best known and scholarly-developed works on basic ballistics.

HOME GUIDE TO CARTRIDGE CONVERSIONS, By Geo. C. Nonte, Jr., Stackpole Books, Harrisburg, Pa., 1967. 416 pp., illus. \$8.95.

A new, revised and enlarged ed. of instructions, charts and tables for making ammunition no longer available, or which has become too expensive on the commercial market.

LYMAN HANDBOOK NO. 44, Lyman Gunsight Corp., Middlefield, Conn., 1967. \$2.50.

Latest edition of a favorite reference for ammunition handloaders, whether voice or veteran.

SHOOTER'S BIBLE RELOADER'S GUIDE, by R. A. Steindler. Shooter's Bible, Hackensack, 1965. Paper-bound. 190 pp., illus. \$3.95.

Over-all coverage of methods and equipment for reloading ammunition for sporting firearms.

COLLECTING

THE AGE OF FIREARMS, a Pictorial History, by Robert Held and Nancy Jenkins. Harper & Bro., N.Y.C., 1957, 192 pp., elegantly and profusely illus. \$7.50.

A graphic history of firearms, particularly interesting for the average person with an interest in arms.

AMERICAN FIREARMS MAKERS, by A. M. Carey, Thomas Y. Crowel Co., N.Y.C., 1953. 146 pp., 7 full page illus. \$2.98.

Lists 2100 makers of American long and short arms from the Colonial period to the end of the 19th century. Out of print, but offered from limited stock by Ray Riling.

ANTIQUE PISTOLS, by S. G. Alexander, illus. by Ronald Paton. Arco Publ. Co., New York, 1963. 56 pp., 12 color plates. \$15.00

The large color plates show many examples of the pistol-maker's art in England and U.S.A., 1690-1900. Commentary on each by a knowledgeable English collector.

ARMS AND ARMOR IN COLONIAL AMERICA, 1526-1783, by H. L. Peterson. Crown, New York, reprint ed., 1964, 350 pp., illus. \$9.95.

Well-organized account of arms and equipment used in America's colonization and exploration, through the Revolutionary period.

ARMS MAKERS OF PHILADELPHIA, by Geo. Shumway, York, Pa., 1967. 300 pp., illus. \$27.00.

A study of the arms industry in old Philadelphia when she was America's foremost city. Contains data on more than 800 gunsmiths and 500 cutlers and edged tool makers. Many illus. of Philadelphia arms and of documents relating to the industry are included.

THE ART OF THE GUNMAKER, by J. F. Hayward; Vol. I, 1500-1660; Vol. II, 1660-1830. St. Martin's Press, New York, 1962-64. Vol. I: 303 pp. plus 64 pp. of illus., \$15.00; Vol. II: 352 pp., 220 illus., \$18.50.

Comprehensive survey of firearms development and ornamentation by leading makers in Europe and the U. S. Prepared by a museum expert with excellent illus., this book offers valuable new information.

BASIC DOCUMENTS ON U. S. MARTIAL ARMS, commentary by Col. B. R. Lewis, reissue by Ray Riling, Phila., Pa., 1956 and 1960.

Rifle Musket Model 1855. The first issue rifle of musket caliber, a muzzle loader equipped with the Maynard primer, 32 pp. \$1.75.

BRITISH MILITARY FIREARMS 1650-1850, by H. L. Blackmore. Arco Publ. Co. Inc., New York, 1962. 296 pp. and 83 plates of photographs, line drawings, appendices and index. \$8.50.

This excellent work admirably and authoritatively covers the subject in every detail. Highly recommended.

THE BRITISH SOLDIER'S FIREARM, 1850-1864, by C. H. Roads. Herbert Jenkins, London, 1964. 332 pp., illus. \$12.50.

A detailed account of development of British military arms at the acme of the muzzle-loading period. All models in use are covered, as well as ammunition.

CIVIL WAR CARBINES, by A. F. Lustyik. World Wide Gun Report, Inc., Aledo, Ill., 1962. 63 pp., illus. paper covers. \$2.00.

Accurate, interesting summary of most carbines of the Civil War period, in booklet form, with numerous good illus.

CIVIL WAR COLLECTOR'S ENCYCLOPEDIA, by Francis A. Lord. Stackpole Books, Harrisburg, Pa., 1963. 384 pp., 350 illus. \$17.50.

A reference work on Civil War relics, for museums, students, writers, and collectors of Union and Confederate items. Identifies arms, uniforms, accoutrements, ordnance material, currency, postage, etc. Many patent drawings. Lists of manufacturers and vendors, North and South, are given.

CIVIL WAR GUNS, by Wm. B. Edwards. Stackpole Books, Harrisburg, Pa., 1962. 464 pp., over 400 illus. \$15.00

Comprehensive survey of Civil War arms, identification data, procurement procedures, and historical data. Important information on replicas, imitations, and fakes.

THE COLLECTING OF GUNS, ed. by Jas. E. Serven. Stackpole Books, Harrisburg, Pa., 1964. 272 pp., illus. \$24.50.

A new and massive compendium of gun lore for serious collectors by recognized experts. Separate chapters cover major categories and aspects of collecting. Over 600 firearms illus. Handsomely designed, deluxe binding in slip case. Reprinted by Crown, N. York, 1966, regular ed., \$5.95.

COLLECTORS' GUNS, by Don Myrus. Arco Publ. Co., Inc., New York, 1962. 128 pp., illus. \$2.50.

The fascinating story of firearms — from the early hand cannon to the Peacemaker — with over 200 rare photographs and illus.

COLT FIREARMS FROM 1836, by James E. Serven. Foundation Press, Santa Ana, Calif., 1964, 398 pp., illus. \$17.95.

5th edition of a comprehensive work on Colt guns, with much historical data, patents, drawings and pho-

tographs of the various models. Most complete and reliable work on its subject.

THE COMPLETE BOOK OF GUN COLLECTING, by Charles E. Chapel. Coward-McCann Inc., N.Y.C., 1960. 222 pp., illus. \$4.50.

Answers hundreds of questions for the beginner, and is a reference for the advanced collector and student of firearms. It covers hand cannon of the 14th century to arms of the present day.

CONFEDERATE ARMS, by Wm. A. Albaugh III, and E. N. Simmons. Stackpole Books, Harrisburg, Pa., 1957. 278 pp., illus. \$12.50.

Contains much heretofore unpublished information on the arms and associated material of the Confederacy.

CONFEDERATE HANDGUNS, by Wm. A. Albaugh III, Hugh Benet Jr., and Edw. N. Simmons. Geo. Shumway, York, Pa., 1963. 272 pp., 125 illus. \$20.00.

Every known true Confederate pistol and revolver is described and illus., with the story of its maker and procurement by the C.S.A. Much new information. Includes listing of C. W. makers and dealers, information on replicas and fakes. Indispensable to the collector and student of these arms and their period.

DUELLING PISTOLS, by J. A. Atkinson. Stackpole Books, Harrisburg, Pa. 144 pp., illus. (incl. color plates), \$12.95.

Account of duelling practice in Great Britain, with data on various types of pistols, their makers, and their users. Memorable duels are recalled, and a bibliography is included.

EARLY AMERICAN GUNSMITHS, 1650-1850, by H. J. Kauffman. A reprint of the Stackpole original by Crown Publishers, N. Y., 1965. 94 pp., illus. \$1.98.

A compilation of records of the men and the arms they made through the subject period.

EARLY PERCUSSION FIREARMS, by Lewis Winant. Wm. Morrow & Co., Inc., N.Y.C., 1959, 292 pp., illus. \$7.50.

A history of early percussion firearms ignition — from Forsyth to Winchester .44-40, from flintlocks of the 18th Century centerfires. Over 230 illus. of firearms, parts, patents, and cartridges — from some of the finest collections here and abroad.

THE EVOLUTION OF THE COLT, by R. L. Wilson, R. Q. Sutherland, Kansas City, Mo., 1967. 54 pp., illus. \$3.00.

Pictures the fine Colt arms of the publisher from percussion to cartridge. Includes a Colt bibliography.

FAMOUS GUNS FROM THE SMITHSONIAN COLLECTION, by H. W. Bowman. Arco Publ. Co., Inc., New York, 1967. 112 pp., illus. \$3.50. The finest of the "Famous Guns" series.

FAMOUS GUNS FROM THE WINCHESTER COLLECTION, by H. W. Bowman. Arco Publ. Co., N.Y.C., 1958 and later. 144 pp., illus. \$2.50.

The gems of the hand and shoulder arms in the great collection at New Haven, Conn.

'51 COLT NAVIES, by N. L. Swayze. Gun Hill Publ. Co., Yazoo City, Miss., 1967. 243 pp., well illus. \$15.00.

The first major effort devoting its entire space to the 1851 Colt Navy revolver. There are 198 photos of models, sub-models, variations, parts, markings, documentary material, etc. Fully indexed.

FIREARMS, by Howard Ricketts. G. P. Putnam's Sons, N.Y.C., 1962. 128 pp., illus., slip case, \$5.95.

An entertaining and colorful summary of the development and use of firearms. Excellent illus. of collectors' arms and related history.

FIREARMS CURIOSA, by Lewis Winant. Publ. for St. Martin's Press, N.Y.C. 2nd reissue, 1961, 281 pp., illus. \$8.50. 3rd reissue, Crown Publ., N.Y.C., 1965, \$2.98.

Describes and illustrates many unusual weapons of collector interest. Some copies of the second (and best) issue available from Ray Riling.

THE FLINTLOCK, ITS ORIGIN AND DEVELOPMENT, by Torsten Lenk; J. T. Hayward, Editor. Holland Press, London, 1964. 192 pp., 134 illus. \$30.00.

First English-text version of the 1939 Swedish work termed "the most important book on the subject." Original illus. are reproduced, and a new index and bibliography complete this valuable book.

FRENCH MILITARY WEAPONS, 1717-1938, by James E. Hicks, N. Flayderman & Co., New Milford, Conn. 1964. 281 pp., profusely illus. \$9.50.

A valuable reference work, first publ. 1938 as Notes on French Ordnance, this rev. ed. covers hand, shoulder, and edged weapons, ammunition and artillery, with history of various systems.

FROM FLINTLOCK TO M1, by J. W. Shields, Jr., Coward-McCann, N.Y.C., 1957, 2nd ed., 220 pp., illus. \$8.50.

An arms collector's history of the development of American military arms — flintlock, percussion, conversions to metallic cartridge, and the magazine arms of today. Out of print, but obtainable from Ray Riling.

GUN COLLECTOR'S HANDBOOK OF VALUES, by Charles E. Chapel. 7th rev. ed., Coward-McCann, N.Y.C., 1966, 398 pp., illus. \$10.00.

The values book most widely used by arms collectors, the latest ed. with 1964-1965 values. Describes nearly 3,000 U.S. and for. firearms and gives much detail of interest to collectors. Bibliography.

GUNS ON THE EARLY FRONTIERS, by Carl P. Russell. Univ. of Calif. Press, Berkeley, Calif., 1962. 395 pp., illus. Paper \$2.45.

This format replaces the original clothbound book, now out of print. It is a history of firearms from colonial times to the years of the Western fur trade.

GUNSMITHS OF OHIO, Vol. I, by Don A. Hutslar. Geo. Shumway, Publisher, York, Pa., 1967. 300 pp., illus. \$25.00.

An exhaustive study of over 2400 Ohio gunmakers, this 1st vol. giving biographical data only. Vol. 2, with illustrations and descriptions of Ohio guns, is in preparation.

HENRY DERINGER'S POCKET PISTOL, by John E. Parsons. Morrow, N.Y.C., 1952. Over 70 illustrations. \$7.50.

An excellent and complete account of this famous maker, coupled with an extensive story on Deringer's imitators, the later cartridge derringers, etc.

HINTS TO RIFLEMEN, by H. W. S. Cleveland. Distributor, Robert Halter, New Hope, Pa., 286 pp., illustrated. \$6.50.

A reprint of the original 1864 edition, to which Practical Directions for the Use of the Rifle has been added.

A HISTORY OF FIREARMS, by W. Y. Carman. Routledge & Kegan Paul Ltd., London, England, 1955, 207 pp., illus. \$4.00.

A concise coverage, from earliest times to 1914, with emphasis on artillery.

A HISTORY OF FIREARMS, by H. L. Peterson. Chas. Scribner's Sons, N.Y.C., 1961. 57 pp., profusely illus. \$3.50.

From the origin of firearms through each ignition form and improvement to the M-14. Drawings by Daniel D. Feaser.

A HISTORY OF WEAPONRY, by Courtlandt Canby, Hawthorne Books, Inc., New York, 1963. 112 pp., illus. \$5.95.

From the caveman's club to the M-14 rifle, from Greek fire to the ICBM.

IDENTIFYING OLD U.S. MUSKETS, RIFLES & CARBINES, by Col. A. Gluckman. Stackpole Books, Harrisburg, Pa., 1965. 487 pp., illus. \$10.00.

Collector's guide to U.S. long arms, first publ. 1959. Numerous models of each type are described and shown, with histories of their makers.

THE KENTUCKY RIFLE, by John G. W. Dillin, Geo. Shumway, Publisher, York, Pa., 1967. 200 pp., illus. \$15.00.

A new 5th ed. of this classic work, brought up to date by the publisher.

LONGRIFLES OF NORTH CAROLINA, by John Bivins, Jr., Geo. Shumway, York, Pa., 1967, 150 pp., illus. \$15.00.

Scholarly study of the American flintlock rifle produced in North Carolina between 1750 and 1850. Biographical data on all known gunsmiths of the region is included.

LONGRIFLES OF NOTE, by Geo. Shumway, Geo. Shumway, York, Pa., 1967. 90 pp., illus. Paper covers. \$2.00.

A review of 35 fine American long rifles, with detailed illustrations showing their art work, plus descriptive material.

MANHATTAN FIREARMS, by Waldo E. Nutter. Stackpole Books, Harrisburg, Pa., 1958. 250 pp., illus. \$10.00.

A complete history of the Manhattan Firearms Mfg. Co. and its products from its inception to dissolution. A scholarly, well researched work of first importance to the serious collector.

THE MANTONS: GUNMAKERS, by W. Keith Neal and D. H. L. Back, Walker & Co., New York, 1966. 300 pp., illus. \$25.00.

Well-documented account of the life and work of John and Joseph Manton, and others of the British gunmakers. A long list, with serial numbers, etc., of Manton guns, is included.

MASTER FRENCH GUNSMITH'S DESIGNS reproduced in facsimile with preface notes by S. V. Grancsay, Greenberg, N.Y.C., 1950. 22 pp. text plus 15 pp. illus. \$8.50.

Originally published in a limited ed. @ \$15.00. Available only from Ray Riling.

MILITARY ARMS OF CANADA, by Upper Canada Hist. Arms Soc. Museum Restoration Serv., West Hill, Ont., 1963. 43 pp., illus. \$1.50.

Booklet cont. 6 authoritative articles on the principal models of Canadian mil. small arms. Gives characteristics of each, makers, quantities produced.

MUSKET TO M14, by C. B. Colby. Coward-McCann, N.Y.C., 1960. 48 pp., illus. \$2.50.

Shows U.S. pistols, rifles and machine guns through the years, including Confederate arms and the Vulcan, Gatling, Eureka, and other multishots.

THE POWDER FLASK BOOK, by Ray Riling. Robt. Halter, Phila., Pa., 1953. 520 large (8½" x 11") pages, 250 full-page illus., showing and describing nearly 1,600 specimens. \$50.00.

In addition to its tremendous amount of information on flasks — foreign, domestic; use, repair, patents, etc. — Riling's book contains much valuable material on firearms and their history. The only book on powder flasks — and no other is likely to be attempted —

this great work is a "must" for the collector.

REMINGTON HANDGUNS, by C. L. and C. R. Karr. Crown, N.Y.C., 3rd ed., 1956, 60 plates, 166 pp., illus. \$2.49.

An enlargement of their fine first edition, the Karrs have added 12 new illustrations and considerable text material. Valuable and informative. The standard reference on Remington pistols.

THE REMINGTON HISTORICAL TREASURY OF AMERICAN GUNS, by Harold L. Peterson. Thomas Nelson & Sons, N.Y.C., 1966. 199 pp., illus. \$4.95.

A historical saga woven into first-rate Americana through the facts and details of the Remington firm and their products.

REVOLVING ARMS, by A. W. F. Taylerson, Walker and Co., New York, 1967. 128 pp., illus. \$8.50.

A detailed history of mechanically-rotated cylinder firearms in Europe and the U.S. Primarily on handguns, but other types of revolving guns are included.

RIFLED INFANTRY ARMS, by J. Schon; trans. by Capt. J. Gorgas, USA. Dresden, 1855; facsimile reprint by W. E. Meuse, Yorktown, Va. 1965. 54 pp., illus. \$2.50.

Reprint of classic essay on European military small arms of the mid-19th century. Paper covers.

THE RIFLED MUSKET, by Claud E. Fuller. Stackpole Books, Harrisburg, Pa., 1958, 302 pp., illus. \$12.50

The authoritative work of the late Claud E. Fuller and basically an account of the muskets whose model dates fell within the Civil War years — 1861, 1863 and 1864. Part Two treats of the contract muskets. Some reproduced material, notably Bartlett & Gallatin's "Digest of Cartridges," is almost wholly illegible, as is much of an 1860 Ordnance Dept. report.

SAMUEL COLT PRESENTS, R. L. Wilson, compiler. Wadsworth Atheneum, Hartford, Conn., 1961. 293 pp., profusely illus. \$10.00.

Showing and describing a profusion of rare and super-rare museum-quality Colt arms exhibited at the Atheneum, it is one of the most important and desirable books on rare Colt arms.

SAMUEL COLT'S NEW MODEL POCKET PISTOLS, by S. G. Keogh. Priv. publ., 1964, 31 pp., 20 illus., paperbound. \$3.00.

"The story of the 1855 Root model revolver," with detailed classification data and descriptions. Well-illus.

THE SHARPS RIFLE, by W. O. Smith. Morrow, N.Y.C., 1943, reprinted 1965, 138 pp., illus. \$7.50.

Study of America's first successful breech-loader patented 1848, with information on its history, development, and operation.

SMALL ARMS AND AMMUNITION IN THE UNITED STATES SERVICE, by B. K. Lewis, Smithsonian Institution, Washington, D.C., 338 pp., plus 52 full-page plates of illus. 2nd printing 1960. \$8.00.

Written and produced for the serious student of arms — a reference work of the first magnitude. It covers the subject from the beginning until after the Civil War. In addition, it clearly reproduces the very scarce "Digest of Cartridges for Small Arms . . ." for the first time. Full leather, gilt edge issue, limited to 50 signed and numbered copies, \$20.00.

THE SOLDIER'S MANUAL, by J. H. Nesmith. (First publ. in Philadelphia in 1824.) Geo. Shumway, York, Pa., 1963. 108 pp., frontis, and 11 color plates. \$13.50.

Facsimile reproduction of an important early American militia drill manual, covering exercises with musket, pistol, sword, and artillery. The color plates depict accurately the picturesque uniforms and accoutrements of elite militia corps of Phila. and vicinity. Intro. by Anne S. K. Brown traces the origin of the text matter in the early engravings.

SUPERIMPOSED LOAD FIREARMS 1360-1860, by D. R. Baxter. Privately printed for the author in Hong Kong, 1966. \$22.00. Foreword by Keith Neal. Ltd. ed., 500 copies only.

Excellent illustrated with photographs, diagrams, figures and patent drawings. Covers over-under arms of all countries, and list of gunmakers and inventors is included.

UNDERHAMMER GUNS, by H. C. Logan. Stackpole Books, Harrisburg, Pa., 1964. 250 pp. illus. \$10.00.

A full account of an unusual form of firearm dating back to flintlock days. Both American and foreign specimens are included.

U.S. MARTIAL AND SEMI-MARTIAL SINGLE-SHOT PISTOLS, by C. E. Chapel, Coward-McCann Inc., N.Y.C., 1962. 352 pp., over 150 illus. \$7.50.

Describes in detail all single shot martial pistols used by the U.S. armed forces and by military units of the states. A definitive guide.

UNITED STATES MARTIAL PISTOLS AND REVOLVERS, by Col. Arcadi Gluckman. Stackpole Books, Harrisburg, Pa., 1939; 3rd printing, 1959. 249 pp. plus appendices and 29 plates. \$7.95.

The models from 1799 to 1917 are fully described and identified, including arms of secondary classification and of contract makers.

U. S. MILITARY FIREARMS, 1776-1956, by Maj. Jas. E. Hicks, J.E. Hicks & Son. LaCanada, Calif., 216 pp., incl. 88 pages of fine plates. \$12.50.

Covering 180 years of America's hand and shoulder weapons. The most authoritative book on this subject. Packed with official data.

U. S. MUSKETS, RIFLES AND CARBINES, by Col. A. Gluckman. The Stackpole Co., Harrisburg, Pa., 1965. A new prtg., 447 pp., plus appendices, etc. Illus. \$10.00.

A dependable and useful work of prime importance in its field.

U. S. SINGLE SHOT MARTIAL PISTOLS, by J. M. Kalman & C. M. Patterson. Chas. Scribner's Sons, N.Y.C., N.D. Unpaginated. 44 full page, full color illus. \$25.00.

A pictorial history of single-shot martial pistols — each plate suitable for framing. Ed. limited to 2500 copies, each numbered and signed by the author and the artist. Text material scanty.

WEAPONS, by E. Tunis. World Publishing Co., N.Y.C., 1954. 153 pp., a large book, well-illus. \$4.95.

A pictorial history of arms with complementing narrative. Coverage: from the first tied stone thrown by pre-historic man to super bombs.

WEAPONS OF THE AMERICAN REVOLUTION, by Warren E. Moore. Funk & Wagnalls, N.Y.C., 1967. 175 pp., well illus. \$7.50.

This timely work brings graphic and textural clarity to the arms used by our forefathers; pistols, long arms, powder horns, accoutrements of every description are covered.

WEAPONS OF THE BRITISH SOLDIER, by Col. H. C. B. Rogers, Seeley Service & Co., London, 1960. 259 pp., illus. in line and halftone plus full color frontis. \$5.50.

The story of weapons used by the British soldier throughout the ages and the many developments in personal arms during the course of history.

THE AMERICAN RIFLEMAN MAGAZINE, Author and Subject Index, Vol. II, Wesley R. Burrell, compiler. W. R. Burrell, Galesburg, Michigan, 1962. Paper covers, 63 pp., \$4.95.

Covers every article in the 1951-1960 issues of *The American Rifleman*. A valuable tool for location of material published in those years.

THE ANATOMY OF FIREARMS, by R. L. Wallack. Simon & Schuster, N.Y.C., 1965. 320 pp., illus. \$6.95.

Guide to guns of all types, ammunition, ballistics, repairs and adjustments, and related topics.

FIREARMS, by H. L. Blackmore. E. P. Dutton, N.Y.C., 1964. 1160 pp. well-illus., paperbound. \$1.75.

Firearms history from its beginnings to recent times. Fine photographs of museum-quality arms.

THE FIREARMS ENCYCLOPEDIA, compiled and publ. by Shelley Braverman, Athens, N.Y., 1960 rev. ed. 530 pp. illus. \$11.25.

An indexed collection of firearms information in

looseleaf form. Thousands of illus. including many exploded drawings.

FREE FOR THE EATING, by Bradford Angier, Stackpole Books, Harrisburg, Pa., 1966. 191 pp., illus. \$4.95.

Discusses and illustrates 100 wild plants and 300 ways to use them.

GREAT AMERICAN GUNS AND FRONTIER FIGHTERS, by Will Bryant, Grosset & Dunlap, New York, 1961. 160 pp., illus. \$3.95.

Popular account of firearms in U.S. history and of the events in which they played a part.

GUNS AND RIFLES OF THE WORLD, by Howard L. Blackmore, The Viking Press, New York, 1965. 290 pp. 1042 halftone and line illustrations. \$30.00.

One of the finest books to come out of England. Covers firearms from the handgun to air, steam, and electric guns.

GUNS AND SHOOTING, A BIBLIOGRAPHY, by R. Riling. Greenberg, N.Y.C. 1951. 434 pp., illus. \$20.00.

A selected listing, with pertinent comment and anecdote, of books and printed material on arms and ammunition from 1420 to 1950.

HOME IN YOUR PACK, by Bradford Angier, Stackpole Books, Harrisburg, Pa., 1965, 192 pp., illus. \$4.50.

An outdoorsman's handbook on equipment, woodcraft, and camping techniques.

HOW TO DEFEND YOURSELF, YOUR FAMILY, AND YOUR HOME, by Geo. Hunter, David McKay, N.Y.C., 1967, 307 pp., illus. \$6.95.

The only book available for the public at large that advocates their ownership of firearms — including handguns. Covers laws of self-defense, setting up home protection, and much else.

HOW TO LIVE IN THE WOODS ON \$10.00 A WEEK, by Bradford Angier, Stackpole Books, Harrisburg, Pa., 1959. 269 pp., illus. \$5.00.

Modern-day homesteading explained by an expert; where to go and how to achieve freedom and comfort on today's frontiers.

HOW TO SHOOT . . . RIFLES, SHOTGUNS & HANDGUNS, by Larry Koller. Doubleday, Garden City, N.Y., 1964, 242 pp., well illus. \$7.50.

Basic firearms fundamentals for beginner and expert alike, with chapters on each type of arm and data on selection, fit, sights, and operation.

INSTINCT SHOOTING, by Mike Jennings, Dodd, Mead & Co., N.Y.C., 1959. 157 pp., 20 line drawings, illus. \$3.50.

All about Lucky McDaniel and his surprisingly successful discovery of a new aerial shooting technique,

one which will let almost anyone, novices preferred, hit flying targets with only minutes of instruction.

L. D. NIMSCHKE, FIREARMS ENGRAVER, by R. L. Wilson. John J. Malloy, publisher, Teaneck, N.J., 1965. Quanto, 107 pp., profusely illus. \$17.50.

Showing a wide variety of designs, initials and monograms and ever-so-many portions of collectors' arms. A thoroughly interesting work for the collector and an inspiration to the engraver.

NO SECOND PLACE WINNER, by Wm. H. Jordan, publ. by the author, Shreveport, La. (Box 4072), 1962. 114 pp., illus. \$5.00.

Guns and gear of the peace officer, ably discussed by a U.S. Border Patrolman for over 30 years, and a first-class shooter with handgun, rifle, etc.

PAGEANT OF THE GUN, by Harold L. Peterson, Doubleday & Co., Inc. Garden City, N.Y., 1967, 352 pp., profusely illus. \$5.95.

A storehouse of stories on firearms, their romance and lore, their development and use through 10 centuries. A most satisfying history of firearms chronologically presented.

SHOOTER'S BIBLE, Hackensack, N.J., 1966. No. 57. Paperbound, 576 pp. \$3.95.

Complete guide to firearms and accessories. Over 25,000 items described, with some 8500 illustrations.

SHOOTING MUZZLE LOADING HAND GUNS, by Charles T. Haven. Guns Inc., Massachusetts, 1947. 132 pp., illus. \$6.50.

A good summary of shooting methods, both contemporary and modern. Duelling with M. L. handguns is also covered.

SKETCH BOOK 76: The American Soldier 1775-1781, by R. Klinger and R. A. Wilder, Arlington, Va., 1967, 53 pp., illus. Paper covers. \$2.25.

Sketches, notes, and patterns compiled from a study of clothing and equipment used by the American foot soldier in the Revolutionary War.

SMALL ARMS OF THE WORLD, by W. H. B. Smith, et al. Stackpole Books, Harrisburg, Pa. 1966, 8th ed., rev. and enl'd. 723 pp., profusely illus. \$17.95.

The only book that shows in pictures and detailed drawings, how to load, strip, and operate the small arms of most nations. Aside from its practical usefulness to students of military arms, it is of prime importance to collectors and shooters.

TEACHING KIDS TO SHOOT, by Henry M. Stebbins. Stackpole Books, Harrisburg, Pa. 1966. 96 pp., illus. \$2.95.

Designed for parents and teachers who want to develop safety conscious firearms-users.

TEXTBOOK OF SMALL ARMS, 1929. Reprint of an official British publ. Holland Press, London, 1961. 427 pp., illus. \$12.50.

Reprint in facsimile of an official prime source on military rifles, swords, bayonets, revolvers, grenades, machine guns, cartridges, ballistics, etc.

WEAPONS AND TACTICS, HASTINGS TO BERLIN, by Jac Weller, St. Martin's Press, New York, 1966. 238 pp., illus. \$6.00.

Primarily on the infantry weapons of today, with basic data on those of the past.

ANTIQUE FIREARMS: THEIR CARE, REPAIR AND RESTORATION, by Ronald Lister. Crown Publ., New York, 1964. 220 pp., 66 plates, 24 fig. \$4.95.

A workshop manual for collectors and gunsmiths, giving correct procedures for every step in preserving firearms.

CHECKERING AND CARVING OF GUN STOCKS, by Monte Kennedy. Stackpole Books, Harrisburg, Pa., 1962. 175 pp., illus. \$10.00.

Rev. enlarged clothbound ed. of a much sought-after, dependable work.

COMPLETE GUIDE TO GUNSMITHING, by C. E. Chapel. Barnes & Co., N.Y.C., 1962, 479 pp., illus. \$6.95.

2nd rev. edition, known earlier as Gun Care and Repair, of a comprehensive book on all details of gunsmithing for the hobbyist and professional.

FIREARMS BLUEING AND BROWNING, by R. H. Angier, Stackpole Books, Harrisburg, Pa. 151 pp., illus. \$4.00.

A useful, concise text on chemical coloring methods for the gunsmith and mechanic.

GUN ENGRAVING REVIEW, by E. C. Prudhomme, G.E.R. Publ. Co., Shreveport, La., 1965, 150 pp., profusely illus. (some in color.) \$21.95.

Excellent examples of the gun engraver's art to serve as a guide to novice or expert. Selection of tools, techniques and a directory of engravers is given.

GUNSMITHING, by Roy F. Dunlap. Stackpole Books, Harrisburg, Pa., 714 pp., illus. \$10.00.

Comprehensive work on conventional techniques, incl. recent advances in the field. Valuable to rifle owners, shooters, and practicing gunsmiths.

GUNSMITHING SIMPLIFIED, by H. E. Macfarland. Washington, D.C., 1950, A. S. Barnes, N.Y.C., 1959. 303 pp., illus. \$6.95.

A thorough dependable concise work with many helpful shortcuts.

GUNSTOCK FINISHING AND CARE, by A. D. Newell. Stackpole Books, Harrisburg, Pa. A new printing. 1966. 473 pp. illus. \$9.50.

Amateur's and professional's handbook on the selection, use and application of protective and decorative coatings on gun stocks.

HOW . . . by L. Cowher, W. Hunley, and L. Johnston. NMLR Assn., Indiana, 1961. 107 pp. illus. Paper covers. \$2.95.

This 1961 rev. ed., enlarged by 3 chapters and additional illustrations, covers the building of a muzzle-loading rifle, target pistol, and powder horn, and tells how to make gunflints.

INTRODUCTION TO MODERN GUNSMITHING, by H. E. MacFarland. Stackpole Books, Harrisburg, Pa. 1965. 320 pp., illus. \$6.95.

Up-to-date reference for all gunsmiths on care, repair, and modification of firearms sights and related topics.

LOCK, STOCK AND BARREL, by R. H. McGrory. Publ. by author at Bellmore, N. Y., 1966. Paper covers. 122 pp., illus. \$3.00.

A handy and useful work for the collector or the professional with many helpful procedures shown and described on antique gun repair.

MODERN GUNSMITHING, by Clyde Baker. Stackpole Books, Harrisburg, Pa., 530 pp., illus. \$6.95.

Written for the average artisan with home or small shop facilities. Remains one of the best coverages for the amateur.

THE MODERN KENTUCKY RIFLE, How to Build your Own, by R. H. McCrory. Mc Crory, Wantagh, N.Y., 1961. 68 pp., illus., paper bound. \$3.00.

A workshop manual on how to fabricate a flint-lock rifle. Also some information on pistols and percussion locks.

PROFESSIONAL GUNSMITHING, by W. J. Howe. Stackpole Books, Harrisburg, Pa. 526 pp., illus. \$9.00.

Textbook on repair and alteration of firearms, with detailed notes on equipment and commercial gunshop operation.

BOOK OF PISTOLS & REVOLVERS, by W. H. B. Smith. Stackpole Books, Harrisburg, Pa., 1962. 758 pp., profusely illus. \$13.50. Buy with Book of Rifles and both are \$19.95.

Rev. and enlarged, this encyclopedic reference, first publ. in 1946, continues to be the best on its subject.

HANDGUNNER'S GUIDE, by Chic Gaylord. Hastings House, N.Y.C., 1960. 176 pp., illus. \$7.50.

From choosing a handgun to the psychology of gun-fighting, including drawing and firing for speed and accuracy.

PISTOL AND REVOLVER SHOOTING, by W. F. Roper. Macmillan Co., New York, 7th printing, 1961. 256 pp., illus. \$4.95.

A popular work on handgun shooting, with each type of weapon covered. Chapters on stocks and sights complete a dependable volume.

PISTOLS, A MODERN ENCYCLOPEDIA, by Dr. H. M. Stebbins. Stackpole Books, Harrisburg, Pa., 1961. 380 pp., profusely illus. \$12.50.

An impressive companion to the author's book on rifles, it covers in great detail every facet of the pistol in its many variations and uses.

THE REVOLVER, 1865-1888, by A. W. F. Tayler-son. Crown Publ., N.Y.C., 1966. 292 pp., illus. \$3.95.

Detailed study of 19th-Century British and U.S. revolvers, by types and makers, based on study of patent records.

SHOOTING, by J. H. Fitzgerald. G. F. Book Co., Hartford, Conn., 1930. 421 pp., illus. \$6.50.

An exhaustive treatise on pistol and revolver shooting. From target to trick shooting as the late "Fitz" knew it. Limited stock available from Riling.

AFRICAN RIFLES AND CARTRIDGES, by John Taylor. Stackpole Books, Harrisburg, Pa. 431 pp., illus. \$7.50.

Complete and detailed information on all cartridges and rifles for African game, by one who hunted there for 30 years. Highly recommended.

CALLING ALL GAME, by Bert Popowski. Stackpole Books, Harrisburg, Pa., 1952, 306 pp. Illus. \$4.95.

Practical methods of attracting game, from quail to moose, using artificial decoys and calls.

COMPLETE BOOK OF HUNTING, by Clyde Ormond. Harper & Bros., N.Y.C. 1962. 467 pp., well-illus. \$6.95.

Part I is on game animals. Part II is on birds. Guns and ammunition, game habitats, clothing, equipment, etc., hunters' tips are discussed.

GUNS AND AMMO FOR HUNTING BIG GAME, by Elmer Keith. Petersen Publishing Co., Los Angeles, Calif., 1965, 384 pp., \$12.50. When purchased with a companion book "Mister Rifleman (both books boxed), \$20.00.

An exhaustive work on the study of guns, ammunition and techniques, from choosing a rifle to equipment for the hunt based on the author's 50 years' experience.

HOW TO HUNT DEER AND SMALL GAME, by L. A. Anderson. Ronald Press Co., N.Y.C., 1959. 140 pp., illus. \$3.50.

Practical information for hunters, it includes the selection of arms and ammunition, and the basic fundamentals.

HUNTING SECRETS OF THE EXPERTS, edited by Vlad Evanoff. Doubleday, Garden City, N. Y., 1964. 251 pp., 71 illus. \$4.95.

Hunting lore contributed by 20 experts on all game from rabbit to elk. Tracking, stalking, and shooting techniques are covered, incl. bow-hunting.

LIVING OFF THE COUNTRY, by B. Angier. Stackpole Books, Harrisburg, Pa., 1959. 241 pp., illus. \$5.00.

In a simple and entertaining manner the author explains how to live off nature when emergency arises and how to stay alive in the woods.

THE NEW HUNTER'S ENCYCLOPEDIA, edited by Leonard Miracle and James B. Trefethen, plus specialized articles by over 60 outstanding contributors. Stackpole Books, Harrisburg, Pa. 1966. 1131 pp., profusely illus. with 2047 photos, diagrams, drawings and fullcolor plates. \$24.95.

A massive work covering every detail of every sort of hunting in the U.S., Canada and Mexico.

ON YOUR OWN IN THE WILDERNESS, by Col. T. Whelen and B. Angier. Stackpole Books, Harrisburg, Pa., 1958, 324 pp., illus. \$5.00.

Two eminent authorities give complete, accurate, and useful data on all phases of camping and travel in primitive areas.

A SPORTING CHANCE . . . by D. P. Mannix. E. P. Dutton & Co., N. Y., 1967. 248 pp. illus. with 50 photos. \$6.95.

Unusual methods of hunting the exotic species from hounds to falcons. Inspiring reading for those desiring to get away from the commonplace.

THE BIG GAME RIFLE, by Jack O'Connor. Knopf, N.Y.C., 1952. 371 pp., illus. \$7.50.

A great amount of worthwhile material by the author of *The Rifle Book*, and in some respects surpassing the latter.

RECREATING THE KENTUCKY RIFLE, by Wm. Buchele, Geo. Shumway. Publ. York, Pa., 1967. 83 pp., illus. \$10.00. Ltd. ed., 500 copies.

A delightful work covering historical development, design, raw materials, tools and supplies for making the rifle, etc. Separate folded plans included.

THE RIFLE BOOK, by Jack O'Connor. Random House (Knopf), N.Y.C., 1948. 3rd ed., 1964. 338 pp., illus. \$7.50.

A definitive work, out-of-print until recently, which covers actions, design, ammunition, sights and accessories.

THE RIFLE IN AMERICA, by Philip B. Sharpe. Funk & Wagnalls Co., N.Y.C., 1958, 4th ed., 833 pp., illus. \$17.50.

Encyclopedic coverage on the rifle through its every

phase of usefulness in America. Though not without minor errors it is the most extensive coverage on the subject.

CLAY PIGEON MARKSMANSHIP, by Percy Stanbury and G. L. Carlisle. Herbert Jenkins, London, 1964. 216 pp., illus. \$5.00.

Handbook on learning the skills, with data on guns & equipment and competition shooting at all types of clay targets; by two eminent British writers.

FIELD, SKEET AND TRAPSHOOTING, by C. E. Chapel. Revised ed. Barnes & Co., N.Y.C. 1962. 291 pp., illus. \$5.95.

A useful work on shotgun shooting, including gun types, ammo, accessories, marksmanship, etc.

SHOOTING FOR BEGINNERS, by E. N. Barclay. Percival Marshall & Co., London, 1963. 74 pp., illus. \$1.75.

Concise introduction to British techniques and customs in shotgunning for game birds.

PAMPHLETS & BOOKLETS

10 Commandments of Safety—A leaflet listing the most important rules of gun safety. Free. 2

A JOINT RESOLUTION—A 4-page statement by the National Police Officers Assn. and the National Shooting Sports Foundation, outlining the role of firearms in U.S. history and voicing their stand against ill-planned restrictive gun laws. Free. 1

BASIC PISTOL MARKSMANSHIP—Textbook for basic pistol courses. 25¢ 2

BASIC RIFLE MARKSMANSHIP—Textbook for basic rifle courses. 25¢ ea. 2

THE ELK—125-page report on the Hunting and management of this game animal, more properly called Wapiti. Extensive biblio. \$1.00. 4

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THE GUN LAW PROBLEM—Information about firearms legislation. Free. 2

HANDLOADING MADE EASY—A leaflet answering the neophyte's questions about reloading. Free from National Reloading Mfr's. Assn., 30 High Street, Hartford, Conn.

HOW TO BE A CRACK SHOT—A 14-page booklet detailing everything necessary to becoming an outstanding shot. Free. 3

FUNDAMENTALS OF CLAYBIRD SHOOTING—A 39-page booklet explaining the basics of Skeet and trap in non-technical terms. Many diagrams. 25¢ ea. 4

HANDBOOK ON SMALL BORE RIFLE SHOOTING—80-page booklet, with pictures and diagrams, tells in detail what the beginner should know about marksmanship, equipment, aiming, firing positions, care of the rifle, etc. 25¢ 1

HUNTER SAFETY INSTRUCTOR'S GUIDE—HOW TO CONDUCT AN NRA Hunter Safety Course. 25¢ ea. 2

HUNTING AND SHOOTING SPORTSMANSHIP—A 4-page brochure defining the "true sportsman" and giving information on the outdoor field. Free. 1

JUNIOR RIFLE HANDBOOK—Information about the NRA junior program with short instruction course. (25 copies issued to each new affiliated junior club without charge.) 25¢ ea. 2

NRA HUNTER SAFETY HANDBOOK—Textbook for students. 10¢ ea. 2

NATIONAL SHOOTING PRESERVE DIRECTORY—Up-to-date listing of small game preserves in the U.S. and Canada. Free. 1

SHOOTING'S FUN FOR EVERYONE—The why, when, where, and how of riflery for boys and girls. 20 pp. Free. 1

TRAP OR SKEET FUNDAMENTALS—Handbooks explaining fundamentals of these two sports, complete with explicit diagrams to start beginners off right. Free. 3

WHAT EVERY PARENT SHOULD KNOW WHEN A BOY OR GIRL WANTS A GUN—Straightforward answers to the 15 questions most frequently asked by parents. 8 pp. Free. 1

THE COTTONTAIL RABBIT—56-page rundown on America's most popular hunting target. Where to find him, how to hunt him, how to help him. Bibliography included. \$1.00 ea. 4

FOR THE YOUNG HUNTER—A 32-page booklet giving fundamental information on the sport. Single copies free, 15¢ each in bulk. 4

NRA BOOKLETS—Ranging from 12 to 36 pages, these are articles on specific arms or arms types. Titles available are: Sighting In; the 45 Automatic; The M1 Rifle; Telescopic Sights; Metallic Sights; Duck Hunting; U.S. Cal. 30 Carbine; Remodeling the 03A3; Remodeling the 303 Lee- Enfield; Remodeling the U.S. 1917 Rifle; M1903 Springfield Rifle; Military Rifles and Civil War Small Arms, 50¢ ea. Gun Cabinets, Racks, Cases & Pistol Boxes, 75¢. Deer Hunting, \$1.00.

Under the heading of "Range Plans" are 15 booklets priced from 10¢ to \$1.00. All are described in an order form pamphlet available from the NRA.

NRA FIREARMS & AMMUNITION FACT BOOK—352-page book of questions and answers, ballistic charts and tables, descriptions of firearms and ammunition. NRA, Washington, D.C., 1964. \$2.00 ea. (\$1.75 to NRA members).

NRA FIREARMS ASSEMBLY HANDBOOK, VOLUMES I AND II—Articles describing the assembly and disassembly of various arms. Vol. I, 160 pp., covers 77 guns. Vol. II, 176 pp., 87 guns. Illustrated with exploded view and supplementary drawings. NRA, Washington, D.C., 1960 and 1964. \$3.50 ea. (\$2.50 to NRA members).

NRA FIREARMS HANDLING HANDBOOK—21 major articles on the proper usage of most types of small arms available to civilians. Illus. NRA, Washington, D.C. 1962, 80 pp. \$2.75 (\$1.75 to NRA members).

NRA GUN COLLECTORS HANDBOOK—20 feature articles on all phases of gun collecting, plus a listing of all important museums. NRA, Washington, D.C., 1959. 48 pp., illus. \$2.50 (\$1.50 to NRA members).

NRA HUNTERS HANDBOOK—51 major pieces, 18 shorter ones. NRA, Washington, D.C., 1960. 72 pp., illus. \$3.00 (\$2.00 to NRA members).

NRA ILLUSTRATED INTERNATIONAL SHOOTING HANDBOOK—.... MAJOR ARTICLES DETAILING SHOOTING UNDER ISU rules, training methods, etc. NRA, Washington, D.C., 1964. \$2.50 ea. (\$1.50 to NRA members).

NRA ILLUSTRATED SHOTGUN HANDBOOK—50 articles covering every phase of smoothbore shooting, including exploded views of many shotguns. NRA, Washington, D.C. 1964. 128 pp. \$3.00 ea. (\$2.00 to NRA members).

NRA QUESTIONS AND ANSWERS HANDBOOK—150 queries and replies on guns and shooting. NRA, Washington, D.C., 1959. 46 pp. with index, illus. \$2.50 (\$1.50 to NRA members).

NRA RELOADING HANDBOOK—122 articles plus 18 briefs covering every phase of metallic and shot-shell reloading. NRA, Washington, D.C., 1961. 224 pp., illus. \$4.50 (\$3.50 to NRA members).

NRA SHOOTERS GUIDE—40 articles of high interest to shooters of all kinds. Over 340 illus. NRA, Washington, D.C., 1959. 72 pp., \$3.00 (\$2.00 to NRA members).

NRA SHOOTING HANDBOOK—83 major articles plus 35 shorts on every phase of shooting. NRA, Washington, D.C., 1961. 224 pp., illus. \$4.50 (\$3.50 to NRA members).

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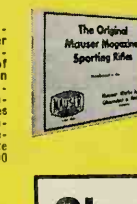
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