Gutta-Percha, Hard Rubber and Synthetics in Firearms

James (Jim) Hardman

The town of Dorset, Vermont is a quiet place, but we do host an antique show that sets up on the village green every other year. A couple of years ago, I saw a fine little parts cabinet for sale. "Those knobs are gutta-percha," the dealer said. "How do you know that?" I asked. I guess I pinched his ulcer because he glowered at me and said "I'm a *professional* . . . and I *know* these things!"

Well, they are not gutta-percha, but the name gutta-percha seems to resonate with antique dealers. Some antique dealers will also tell you that civil war "Union" picture cases were made of gutta-percha. (Figure 1) Some were, but for the most part, these cases were molded of "Mud"—in this case, a mix of natural resins including shellac and blended with pigments and wood flour.

We can't always rely on what we read or what we are told, but we can do our best to avoid perpetuating errors.

In the firearms industry, manufacturers obviously experimented with new materials. New technology could not be overlooked. Many materials found acceptance and were used for significant periods of time.

The industry was market driven. Manufacturers did their best to provide quality products at a reasonable price. Success hinged largely on buyer perception.

Figure 1. "Union" or "Civil War" picture case, likely <u>not</u> gutta-percha, most of these cases were compression molded from shellac mixed with fine sawdust.

Advertising could do just so much, although we certainly smile at some of the testimonials and guarantees of excellence. Some claims were actually understatements. For example, automobile manufacturers would sometimes intentionally understate engine horsepower. You didn't want to own a 30-horsepower car and be passed going uphill by a car rated at only 21-horsepower.

With or without advertising, some materials proved successful and others were tried and rejected. We understand some of the history of these materials and identification is not difficult.

GUTTA-PERCHA

Gutta-percha was one of the early alternatives to traditional stock-making materials (including wood, ivory, pearl, horn, etc.) and attracted a lot of attention when it was introduced in the late 1830s. While it is sometimes called a "synthetic" due to the manufacturing techniques, gutta-percha, or Balata rubber, is not a synthetic at all.

Gutta-percha is a natural product obtained from the "latex" or sap of various rubber trees indigenous to southeast Asia, especially the Malay peninsula. After collecting the latex (Figure 2), the moisture was driven off and the raw gutta-percha was rolled into balls or baled for shipment. After shredding and washing, it was heated and masticated in machines that looked like taffy mixers where coloring

Reprinted from the American Society of Arms Collectors Bulletin 96:15-38
Additional articles available at http://americansocietyofarmscollectors.org/resources/articles/

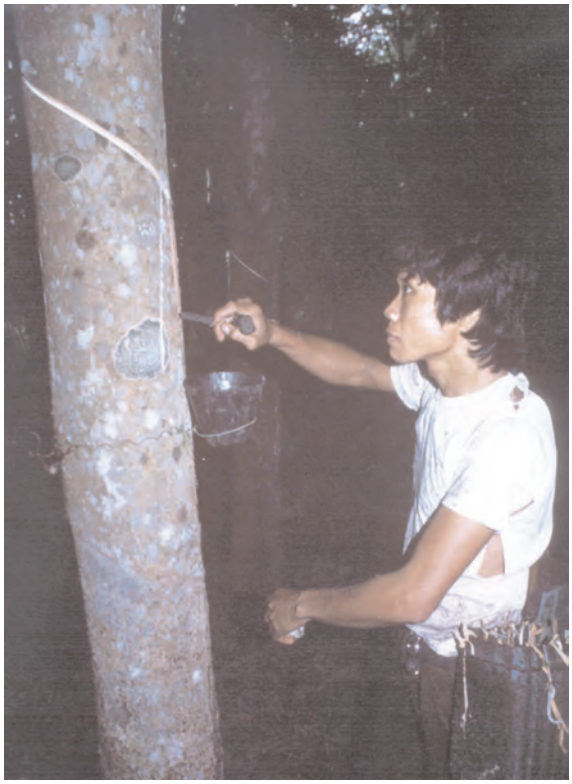

Figure 2. Gutta-percha is chemically similar to natural rubber and is obtained from the sap or "latex" of various rubber trees.

ingredients could be added. The hot, viscous mass was rolled out repeatedly to vent out any entrapped air at which point it was ready for hot molding.[1, 2]

Extruders for gutta-percha were developed in the late 1840s, and was soon used in insulating underwater cables—the stuff is almost non-biodegradable, it is not water soluble and sea creatures don't chew on it.[3]

Typical products molded from gutta-percha include small buckets, funnels, flasks and bottles, doll heads and buttons. Thousands upon thousands of buttons were produced from gutta-percha. The wares pictured in Figure 3 are typical products manufactured in the 1850s and 1860s.[4]

Gutta-percha was used in golf balls (talk about impact resistance!), first for the entire ball, and later as just the cover material because of its toughness and resilience. Original "gutties" are highly collectible and a good, original specimen can fetch up to $3000 today.[5, 6]

With the advent of vulcanized natural rubber, gutta-percha slowly lost market favor until now the industry is a shadow of its former size. It is still molded into little artistic figurines and because it is resistant to bio-degradation and used by dentists to fill root canals.[7, 8]

Sharps used gutta-percha grips on some of their earlier 4-barrel pocket pistols. Later production used vulcanized hard rubber. The advantage was that compression molded grips provided the handsome appearance of high relief carving. (Figure 4)

Firearm embellishment has always been important and most manufacturers offered carved ivory or carved pearl grips as an option. But here was new technology: hot gutta-percha could be squeezed into a mold to create the beauty and complexity of carved grips without the expense of carving. (Figures 5, 6 and 7)

With use and wear, gutta-percha loses its mold luster and grips take on a soft satin sheen. Gutta-percha is a relatively hard substance (about the hardness of a golf ball cover), tough and gnarly. It can be polished, but not nearly as well as hard rubber. Hard rubber can be polished to a mirror finish—pipe stems are a good example. Gutta-percha grips are often wiped with oil to make a better presentation. (Figure 8)

Figure 9 pictures a molded gutta-percha grip with an unusually leathery apperance. Most gutta-percha has a satin sheen, but this grip is distinctly granular. It is probably not the result of aging or weather exposure, as gutta-percha is extremely resistant to bio-degradation. This appearance is more likely a matter of where the polymer was grown and how it was processed and cleaned prior to molding. Figure 10 shows the interior of this grip and the imprint of the compression mold used to force the hot polymer into the carved recesses of the mold. (Jim Shaffer collection.)

The interior of a gutta-percha grip from a Remington-Rider 31 caliber percussion revolver is shown in Figure 11. Again, note the "hollow" interior where the proud side of the mold forced the hot, viscous material into the checkering detail. This grip is likely to be an early model as these revolvers were initially manufactured around 1860.

A very unusual grip is pictured in Figure 12. It shows a gutta-percha grip from an early Remington .41 caliber double derringer. For whatever reason, the gutta-percha was molded over a heavy metal plate having several holes to engage and firmly hold the polymer. This is a smooth grip, without

Figure 3. Typical products made from gutta-percha during the 1850s and 1860s. Note the natural satin finish. Gutta-percha offered wonderful resistance to bio-degradation.

Figure 4. Gutta-percha grips were handsome and offered the look of upscale quality. Frank Sellers collection, image courtesy Rock Island Auctions.

Figure 5. Embellishment was popular, displayed by these carved ivory grips from Sharps. Carved ivory is highly esteemed by collectors. Frank Sellers collection.

Figure 6. Carved pearl grips on a Sharps 4-barrel pistol. Frank Sellers collection.

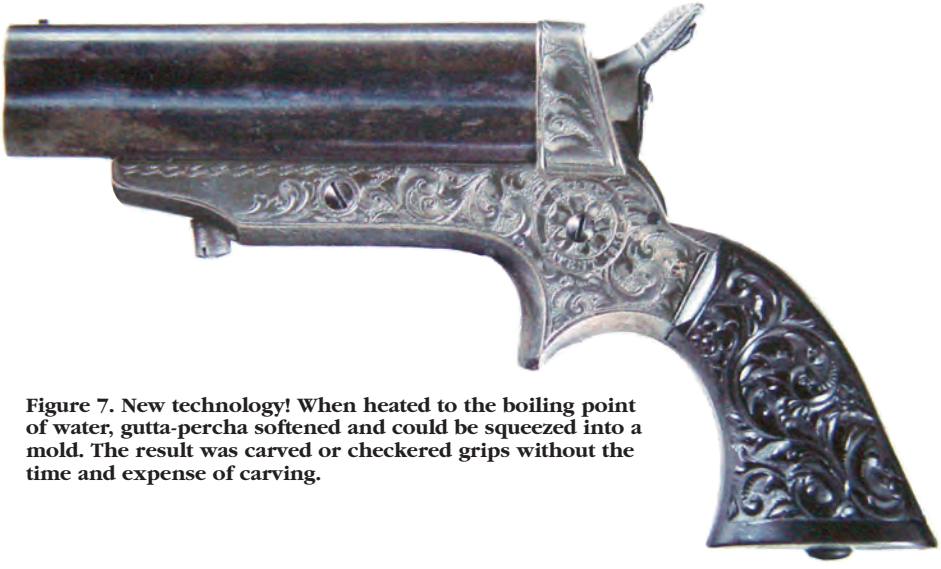

Figure 7. New technology! When heated to the boiling point of water, gutta-percha softened and could be squeezed into a mold. The result was carved or checkered grips without the time and expense of carving.

Figure 8. Gutta-percha has a soft satin sheen, it is a tough and gnarly substance with superb impact resistance. Image courtesy Rock Island Auctions.

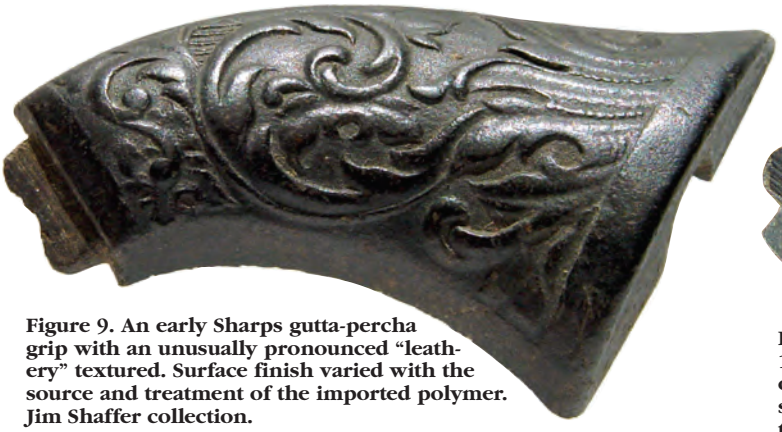

Figure 9. An early Sharps gutta-percha grip with an unusually pronounced "leathery" textured. Surface finish varied with the source and treatment of the imported polymer. Jim Shaffer collection.

Figure 10. Interior of Sharps grip showing pressure protrusion in the mold which forced hot gutta-percha into the detail of the mold.

Figure 11. Interior of a Remington-Rider gutta-percha grip showing the shape of the pressure plate. These are unusually thin walls for a gutta-percha grip. Jim Shaffer collection.

Figure 12. An early Remington double derringer gutta-percha grip molded over a metal plate having holes to engage the polymer. These plates were apparently designed to help resist deformation. Jim Shaffer collection.

checkering, probably dating back to early production which started in about 1863. (Jim Shaffer collection.)

Remington used gutta-percha to cover their cane guns. Fellow member Elliott Burka made a superb presentation in 2002 on Remington cane guns and Figures 13 and 14 are scanned from his text published in Society Bulletin No. 85.[9]

The protective covering over the brass cane shafts was relatively thin and necessarily had to resist the abuses suffered in use. Mr. Burka noted that cracks are not uncommon, especially around the ferrules.

The natural color of gutta-percha is a deep brown to black and varied with the species of tree and the location,

Figure 13. 9. Remington covered the shafts of many of their cane rifles with gutta-percha which provided a handsome appearance and endured both use and abuse. Elliott Burka collection.

Figure 14. Gutta-percha was naturally a deep brown to black, but pigments could be added for lighter colors.

but the addition of various pigments allowed production of lighter colored products. The coral colored cane pictured in Burka's presentation is an outstanding example.

More accurately, Remington used both gutta-percha and hard rubber. Fellow member Vern Eklund found a Remington advertisement that speaks of both materials being used. (Figure 15)

In their series "Wild West Tech," the History Channel stated that "Bat Masterson wanted a nickel-plated revolver with a barrel no longer than the ejector housing. And he wanted gutta-percha grips. Gutta-percha is a fancy name for a plastic that's a lot like rubber." (Figure 16)[10]

I never met Bat Masterson . . . and perhaps he did ask for gutta-percha. But by the 1870s, gutta-percha was simply not a material of choice in firearms. Park your revolver too near a wood stove and the grips could soften and deform.

There were two significant advantages of hard rubber over gutta-percha:

(1) Hard rubber could be polished to a higher luster.

(2) Hard rubber did not soften and deform when heated.

MUD

A step down in quality but huge in terms of industrial use was a class of products known as "Mud." This material is often confused with gutta-percha.

Mud is a classic example of an almost-lost technology. Even the name has disappeared from the textbooks (perhaps because the name was considered degrading), although the men in the trade 100 to 150 years ago used the name "Mud" and they surely knew how to make it. There is no set formula for Mud, but in general, it is a mix of various natural resins akin to shellac or rosin with some fillers and coloring agents added. By filler, I mean ground-up mined calcium carbonate, sawdust, or even kitchen flour which was added to the molten base resin. After cooling, the solidified "Mud" was ground up into little chips and was ready for molding. (Figure 17)[11]

Figure 15. Remington advertising suggests that some canes were covered with vulcanized rubber. Image courtesy of Vern Eklund.

Figure 16. Bat Masterson is said to have wanted gutta-percha grips. Did he really mean that?

Figure 17. "Mud" was a mixture of hot-melt resins similar to rosin or shellac used in molding. Hardness was adjusted by the choice of resins and diluents; pigments offered a broad range of colors.

Figure 18. The surface detail of products molded from "Mud" was excellent; this is the surface of a Littlefield & Parsons picture frame.

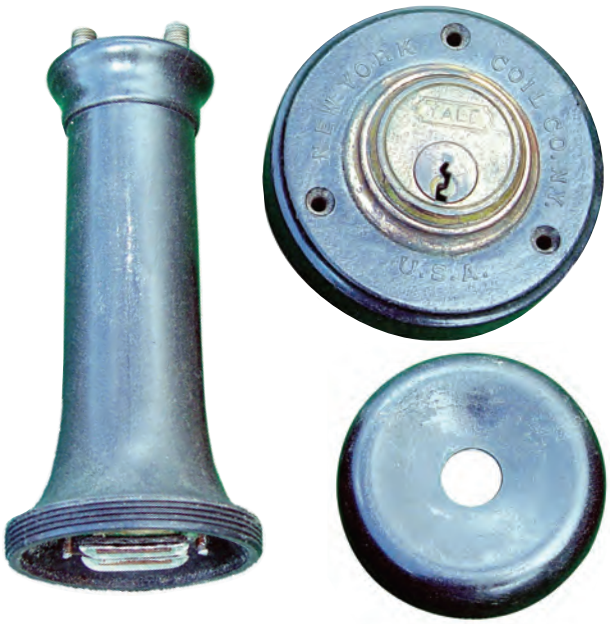

Figure 19. Mud was durable enough for telephone handsets, but not many firearms were fitted with mud grips.

Figure 20. All sorts of games and household products were molded from mud.

Figure 21. The beautiful red mottled side plates of circa 1877 Philbrook and Paine fly reels are often declared to be " hard rubber," but in fact, they are molded of "Mud." Image courtesy of American Museum of Fly Fishing.

Mud could be purchased commercially from any of several sources. Suppliers offered formulations in different melt temperatures and colors, and in order sizes ranging from 50 pound bags right up to railroad cars. In later years, Mud was injection-molded, but most custom molders used simple steam-heated compression molds. The chips were sprinkled in, the resin melted and the "ooze," or "Mud," was pressure molded into the desired shape.[12]

Surface detail was generally excellent and costs were minimal; the greatest cost was the cost of the mold itself. It took an artisan to carve, polish and fit an iron mold. Simple molds were cast over patterns made from various compositions of clay and more expensive molds were hobbed from hardened steel masters. The presses used were similar to the "paper presses" often seen in antique shops. They had two plates and a hand wheel on top. (Figure 18)

Neat stuff, this Mud. It was commonly used for telephone handsets, ignition boxes, toys and games, doll heads and yes, even cabinet drawer knobs. (Figures 19 and 20)

The beautiful mottled side plates on the model 1877 Leonard fly reel are often mistaken for gutta-percha or hard rubber, but these mottled orange and black side plates were hot-molded from Mud. (Figure 21)

Men in the trade would have scoffed at the notion that most civil war "Union" picture cases were molded from gutta-percha. They would have known that they were Mud. U.S. Patent 159,155 details the shellac and wood flour composition recommended for picture cases.

Smith & Wesson purchased their fine "gutta-percha" presentation cases from frame makers, most likely Littlefield, Parsons Company. The detailing was excellent and these cases are highly prized by collectors. The name "gutta-per-

Figure 22. To this day, S&W presentation cases are erroneously called "gutta-percha" cases. In truth, they were molded from "Mud."

Figure 23. These S&W presentation cases were molded by the Littlefield & Parsons Company from a mixture of shellac and wood flour.

Figure 24. Molded "Mud" Whitney Monitor grips with embedded wire for reinforcement. Mud grips are rare, surface detail is excellent. Jim Shaffer collection.

cha" sticks, but these cases were in fact molded from Mud. (Figures 22 and 23)

Mud did not find widespread use in the firearms industry and examples are rarely encountered. The grips in Figure 24 are from a Whitney Monitor .22 revolver and these grips are indeed Mud. The surface detail of the vine and leaf motif is superior. Wire reinforcements were embedded at the time of casting, and can easily be seen where one grip has chipped. These wire loops were most likely installed to minimize distortion and provide strength in the same manner that reinforcing rods are used when pouring concrete. These grips are from Jim Shaffer's collection.

Mud had its drawbacks, especially its' tendency to crack and chip on high impact, much like dropping an old 78 RPM shellac phonograph record. Mud had the advantage of very low cost and excellent surface detail, but high heat caused re-melting.

How do you identify Mud? Heat up a needle until it is hot and gently touch it to the sample in an inconspicuous place. If it melts easily, it is probably Mud. If it softens but does not melt, it could be gutta-percha. If it does not melt or soften, it is likely hard rubber or Bakelite. (Figures 25 and 26)

The test for hard rubber is to rub it briskly on your pants and quickly smell it. You won't forget the smell of warm rubber. Gutta-percha doesn't have that odor. But, rub Mud on your trousers and it is likely to smear.

HARD RUBBER

Hard rubber, also known as Ebonite in Britain, became a material of choice for firearms grips and shotgun butt plates. It was commonly used in the United States. Natural rubber, like gutta-percha, is obtained from the sap of rubber trees. (Figure 27) The difference between natural rubber and gutta-percha seems minimal; both are chemically 1,4 polyisoprene, only the orientation is different. Natural rubber is **"cis"** 1,4 polyisoprene and gutta-percha

Figure 25. A simple test for "Mud" involves gently probing with a hot needle to see if it melts. Dave Burghoff at the Hartford show.

Figure 26. The hot needle should be applied in a hidden area to avoid surface damage.

is **"trans"** 1,4 polyisoprene. But oh, what a difference when natural rubber is vulcanized.[13]

In the early years, little was known about the differences in the latex produced by the 200 or so known species of rubber trees. Some trees produced natural rubber, others produced gutta-percha. Natives would score the bark and collect the sap (or latex) in buckets in the same way Vermonters collect sap for maple sugar. They would dip paddles into it, dry it over a fire, and then peel off the "smoked sheet" and package it into bales. Early production was slow and expensive. A more efficient way was to coagulate the latex with vinegar (acetic acid) and then squeeze out the crumbles in a filter press.[14]

Figure 27. Natural rubber is chemically close to gutta-percha and is acquired from the sap or latex of rubber trees. These plantation trees are part of a huge agricultural enterprise; some species of trees yield gutta-percha, others product natural rubber.

Unlike gutta-percha, which was tough and gnarly in its raw state, natural rubber was soft and gummy. Uses for raw natural rubber were limited. Shoes could be coated with raw rubber to waterproof them, but getting them warm spelled trouble. Raw rubber has the consistency of chewing gum and walking on hot pavement was impossible—the rubber would soften like taffy and stick to the sidewalk.

But Charles Goodyear changed everything. He added sulfur to the raw rubber and found that with heat, a chemical reaction occured allowing rubber to retain its desired shape even when warm. Goodyear was not the first to experiment with sulfur, but his approach was practical and he received a patent for it in 1844. (Figure 28)[15]

A little sulfur produced stretchy rubber and more sulfur produced hard rubber or Ebonite. The sulfur and other ingredients had to be "mixed in the solid" using heavy two-roll mills. Figure 29 shows the 2-roll mill used in our family's rubber plant in Belleville.

Figure 28. Charles Goodyear patented the process of "vulcanizing" or heating natural rubber with sulfur to create stable rubber products.

Figure 29. A two-roll mill used to mix sulfur and compounding ingredients with raw rubber "in the solid." The hardness of the vulcanized rubber varies with sulfur concentration.

Larger mills were common for rolling out sheet stock and removing entrained air. A typical Farrell 3-roll calendar is pictured in Figure 30.[16]

The compounded rubber was cut into appropriately sized pieces which were pressed like dough into heated compression molds. Quoting from an 1896 visit to the Cleveland Rubber Company, "It takes every impression; it does not melt, but heat softens it to the consistency of taffy . . . a greater heat vulcanizes it." (Figure 31)[17]

I don't mean to dwell on the processing of natural rubber. But understand this: **All natural rubber was not the same.** Not only were there many species of trees, but gathering and refining was in no way consistent. Some crudes were contaminated with dirt, sticks and stones, which obviously affected the price paid. But all of this was included in the mix and affected the quality of the hard rubber produced. In truth, quality varied over the lot. Even the sources of rubber added to the confusion. With increasing demand, rubber trees were exported from southeast Asia to new plantations in Brazil. It was said that the Brazilian distribution ports were "inhabited by an international assortment of human driftwood and desperados." It is no wonder that there was little or no standardization. All of these variations affected the quality of the grips, flasks and stocks manufactured by the firearms industry.[18]

Our family was involved in the rubber industry. (Figure 32) My great-grandfather and grandfather supplied a broad

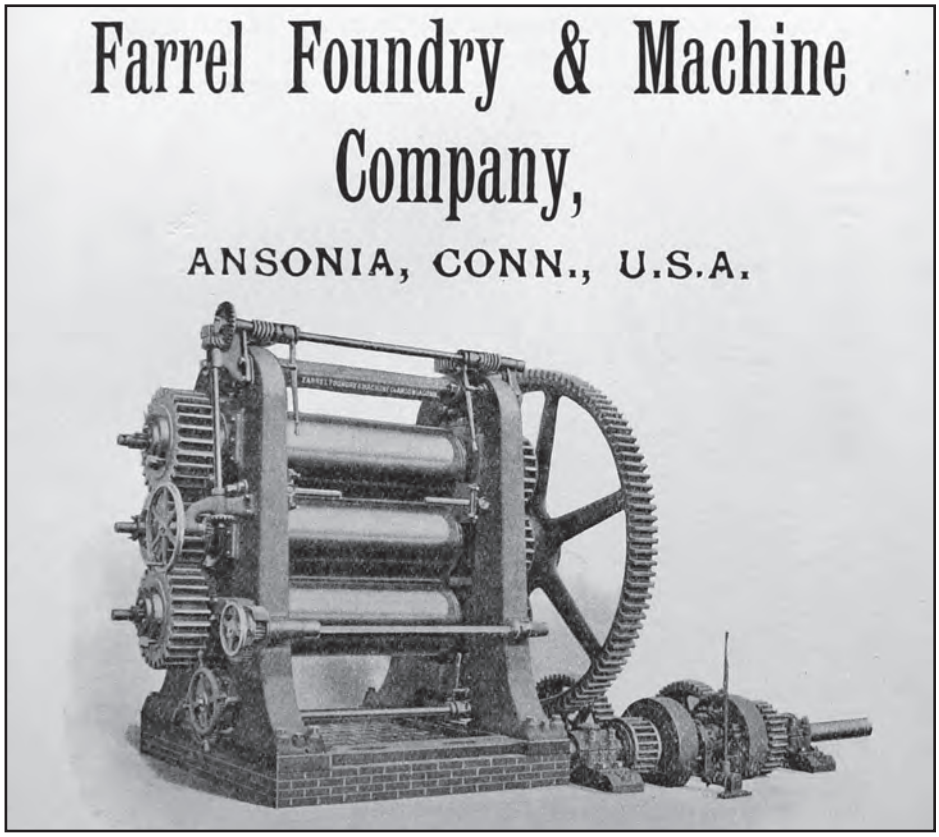

Figure 30. Three roll "calendars" rolled rubber compounds into sheets prior to being cut up for compression molding.

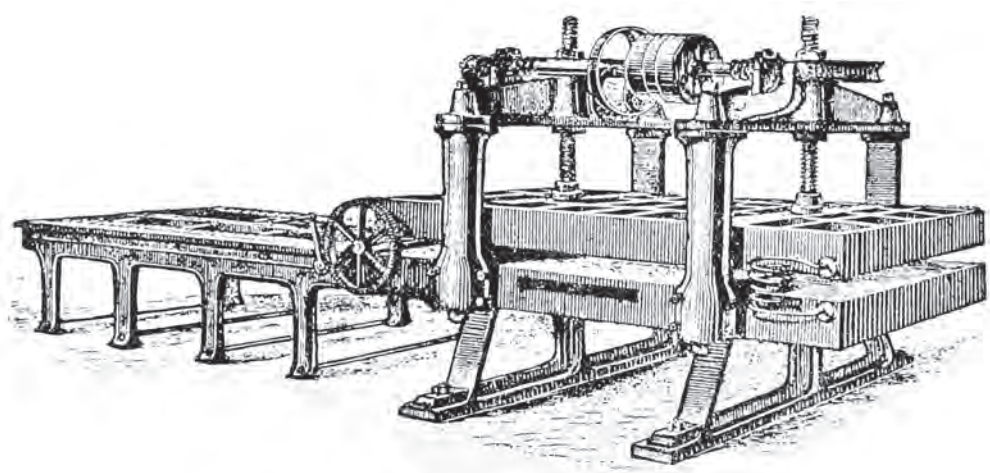

Figure 31. Simple compression molds used high pressure steam to heat and "vulcanize" rubber products; the process was smelly and took about four hours for each molding.

line of hot water bottles and hard rubber drug sundries to the trade. Figures 33, 34 and 35 include catalogued enema and douching nozzles, ear syringes and hair brushes.[19]

The family business in Belleville, New Jersey grew until a fire in 1906 put our 400 employees out of work. The factory was underinsured and was never rebuilt, but my grandfather continued in the business and did what he could with what he had. (Figures 36 and 37)

After partnering with a friend, he manufactured smoking pipes, golf club heads and automobile tires. In later years, on his own, he molded battery boxes and formulated hard rubber settings for the manufacture of paint brushes. (Figures 38 and 39)

Figure 40 shows Dr. Scott's Electric Hair Brush from Dick Littlefield's collection.

The box said it cured headaches in 5 minutes and similar products were in daily use by the Queen and the Prince and Princess of Wales.

The pistol-shaped pipes in Figures 41 and 42 are molded from hard rubber, also from Dick Littlefield's collection.

A Beacon Dam hard rubber powder flask is shown in Figure 43, clearly marked "Goodyear's Patent." Another design of hard rubber flask, unmarked, but possibly also Beacon Dam, is shown in Figure 44. These hard rubber flasks proved durable, and are often encountered in larger rifle and shotgun sizes.

Companies like American Hard Rubber in New York City manufactured and sold hard rubber as a raw material in the form of sheets and bar stock. Any shop with a lathe and a milling machine could purchase vulcanized stock and fabricate parts from hard rubber.

The upscale market was for molded parts with fancy shapes and designs. These parts had to be molded and suppliers were all too happy to vulcanize parts in custom steam-heated molds.

Figure 32. The Hardman family was involved in the rubber trade; this is a circa 1895 picture of the old factory in Belleville, New Jersey.

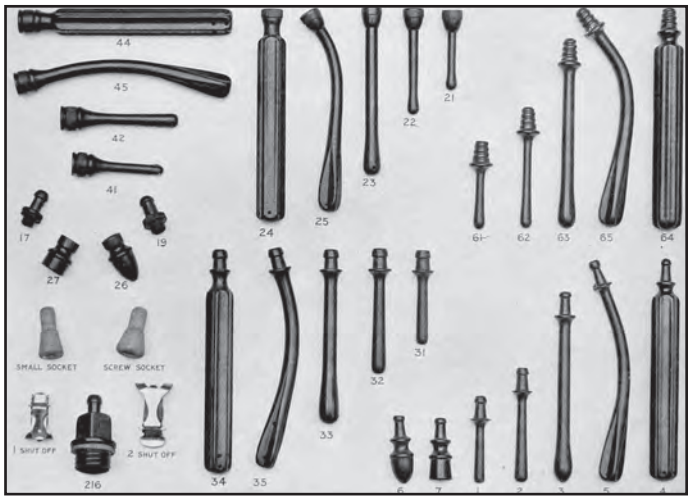

Figure 33. Hardman molded hot water bottles and hard rubber drug sundries including these enema and douching nozzles.

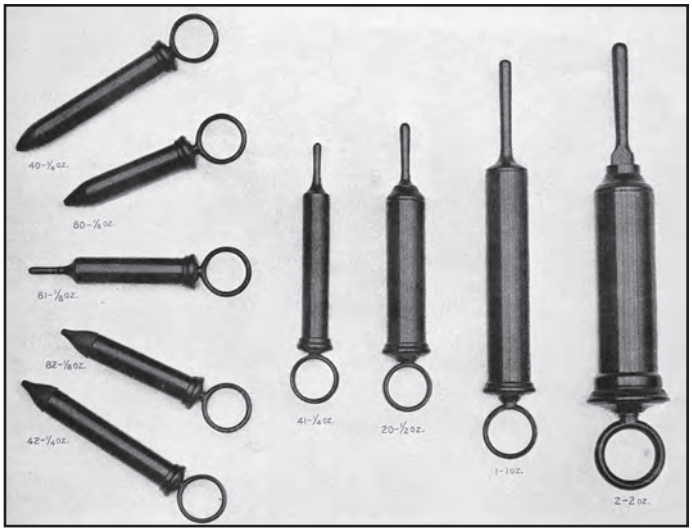

Figure 34. Hard rubber ear syringes from the circa 1900 catalogue.

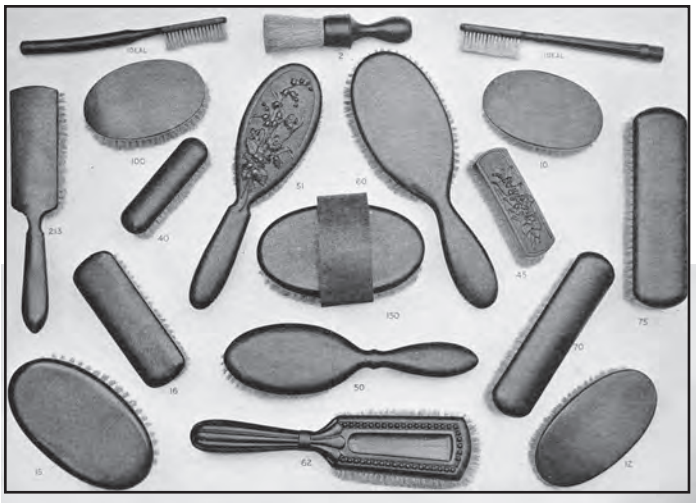

Figure 35. Hard rubber (or "Ebonite") was popular for use in hair brushes and was broadly accepted for use in handgun grips and shotgun butt plates.

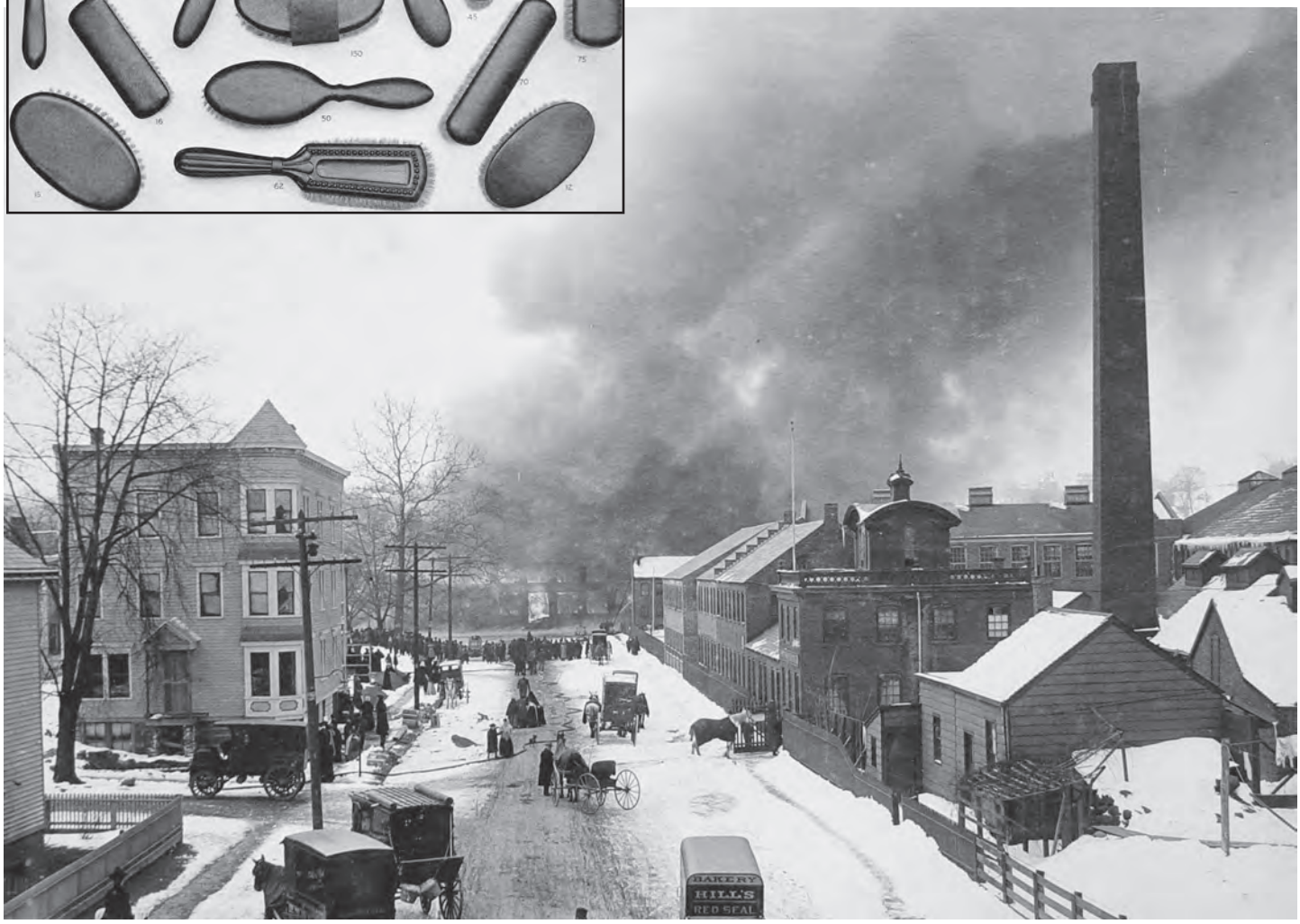

Figure 36. The factory in Belleville, New Jersey, burned in early 1906 and put 400 people out of work.

Figure 37. The original factory was never rebuilt, but my grandfather continued molding hard rubber.

Figure 38. By 1910, Grandfather was molding hard rubber smoking pipes and shaving brushes.

Figure 39. Hard rubber golf club heads were manufactured, but wood proved a more popular material.

Figure 41. Pistol-shaped hard rubber pipes from the Dick Littlefield collection.

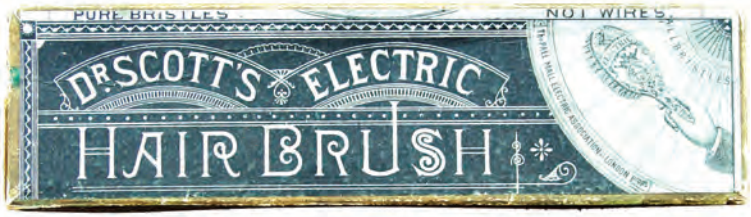

Figure 40. A hard rubber hair brush from England, said to cure headaches in five minutes.

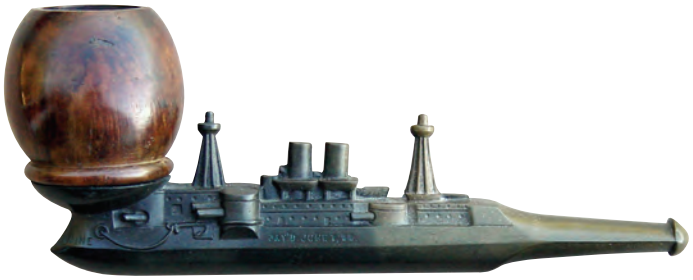

Figure 42. Hard rubber ship and rifle pipe, also from the Dick Littlefield collection.

Figure 44. Hard rubber flasks were supplied in both pistol and rifle sizes; this flask is unmarked.

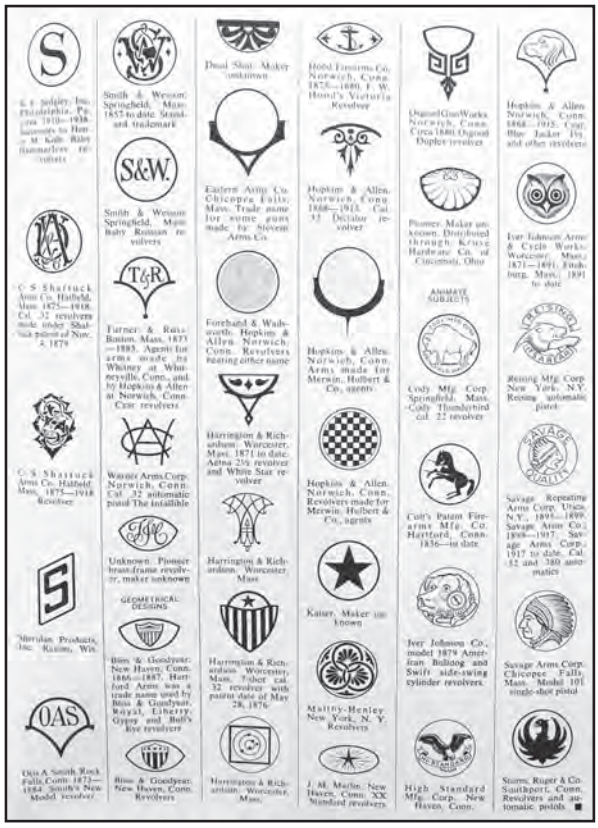

Figure 45. Arms makers sold hard rubber grips with custom monograms, designs and patent dates; many of these designs are pictured in Hershel Logan's article in the NRA publication *The Gun Collector's Guide.*

Figure 43. A Beacon Dam hard rubber powder flask marked "Goodyear's Patent."

Arms manufacturers were able to purchase checkered grips incorporating proprietary names, trademarks, artistic designs and patent dates. Understand that custom molding was smelly and expensive; it took about four hours at 275 to 400 degrees to vulcanize a set of handgun grips. Unless you were the size of a Colt or Smith & Wesson, it didn't make sense to manufacture your own grips. Grips were outsourced, and as a result, once again, quality and composition varied all over the lot.

Many of these trademarks are pictured in an article by Hershel Logan in the NRA publication *The Gun Collector's Guide*. (Figure 45)[20]

Some designs were complex: a set of Iver Johnson Defenders is pictured in Figure 46 and the classic Colt "Cop and Thug" picture grips are shown in Figure 47.

The side plates of the Chicago Palm Pistol incorporated intricate spiral designs and were molded of hard rubber. (Figure 48)

At least three different hard rubber formulations appear to have been used on Colt Single Actions and the 1878 Double Actions. The base color varies and they do not look identical. It would seem that Colt tried grips with different formulations or perhaps purchased from three different suppliers. (Figure 49)

Suppliers and custom molders abounded. Goodyear-licensed processors and manufacturers and names like Converse, India Rubber Co., American Hard Rubber Co., Christopher Meyer, Providence Rubber, Revere Rubber,

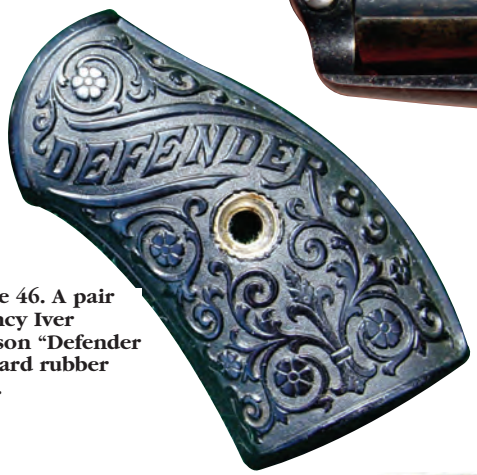

Figure 46. A pair of fancy Iver Johnson "Defender 89" hard rubber grips.

Figure 47. The classic Colt "Cop and Thug" pattern hard rubber grips.

Figure 48. The hard rubber side plates of the Chicago Palm Pistol were molded with intricate spiral patterns.

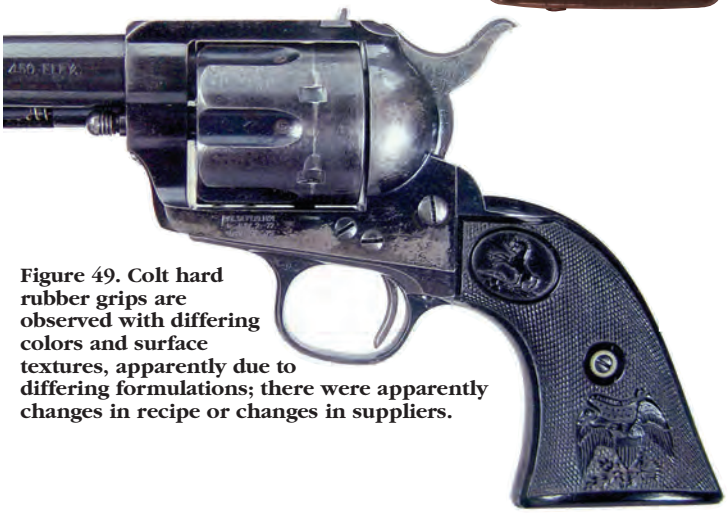

Figure 49. Colt hard rubber grips are observed with differing colors and surface textures, apparently due to differing formulations; there were apparently changes in recipe or changes in suppliers.

Woonsocket Rubber, Cleveland Rubber and Boston Rubber Shoe became household names. During the decade of the 1870s, Christopher Meyer alone produced over 50 million hard rubber buttons per year. And all this prior to the growth of the huge automobile tire industry including Goodyear, Goodrich, Armstrong, Dunlop, Cooper, etc.[21]

Not all hard rubber was black, but carbon black was a preferred ingredient because of its ability to associate with the rubber during vulcanization. Carbon black truly added reinforcement. But the technology was available to produce lighter colors if desired. The fact that darker colors were generally chosen speaks more of a marketing decision than manufacturing capability. Samples of white hard rubber are shown in Figure 50.

Two remarkable Spiller & Burr revolvers were exhibited by member Cliff Young at the

Figure 50. Not all hard rubber was black, although carbon black was a reenforcing filler. Mottled red hard rubber is frequently encountered, but lighter colors, although available, never proved popular in firearms.

Burlington meeting. One revolver had coral colored grips that testify to what could be produced during the civil war era. These grips are early and while they could be gutta-percha, I suspect that they are hard rubber. The color, fit, and polish are superb. (Figure 51)

The mottled red and black hard rubber grips used by Smith & Wesson and others were absolute eye-catchers. Figures 52 and 53 show the differences in swirl pattern, an art in itself in terms of blending and molding technique. Smith & Wesson routinely provided mottled red hard rubber grips on their nickel-plated revolvers.

Photographs of the steel hobbs used to manufacture the molds for the production of the mottled red forearms and hard rubber butt plates for Smith & Wesson's revolving rifles appear in *Artistry in Arms* by Roy Jinks. These were engraved and checkered by Gustav Young circa 1879. Although most hard rubber suppliers desired to own custom molds as a means for ensuring future business, these hobbs were invoiced directly to Smith and Wesson. (Figure 54)

Figure 51. Spectacular coral-colored grips on a Spiller and Burr revolver. Clifford Young collection.

Figure 52. Smith & Wesson mottled red and black hard rubber grips were impressive and handsome. These colorful grips were often fitted to S&W's Nickel plated arms.

Figure 53. A second pattern of S&W mottled red grips, these more like a wood grain than a swirl. David Burghoff collection.

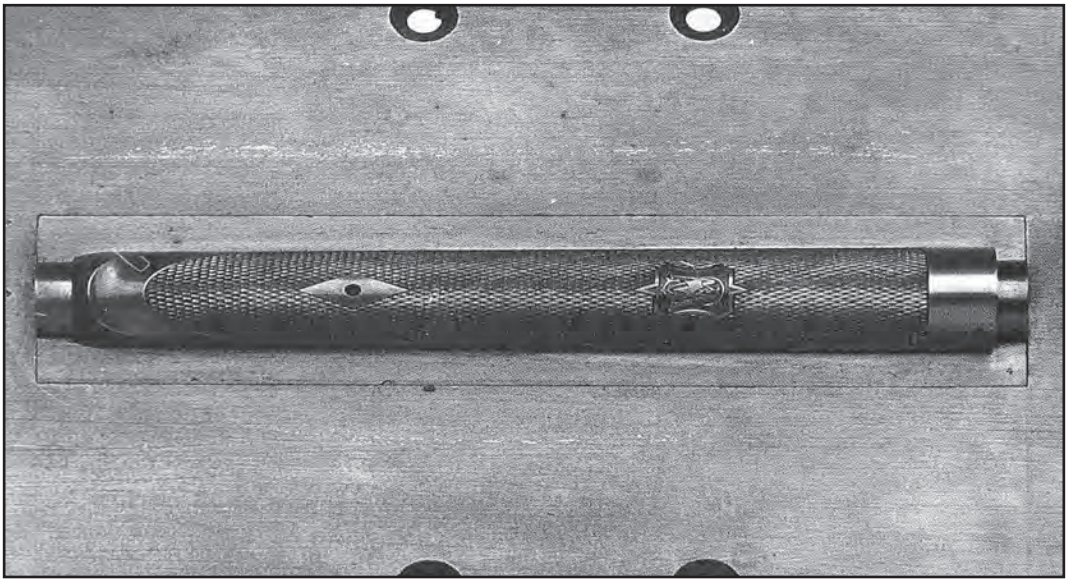

Figure 54. This steel hobb was engraved and checkered by Gustave Young prior to hardening; it was used to make the molds for S&W's mottled red revolving rifle forearms. Roy Jinks collection.

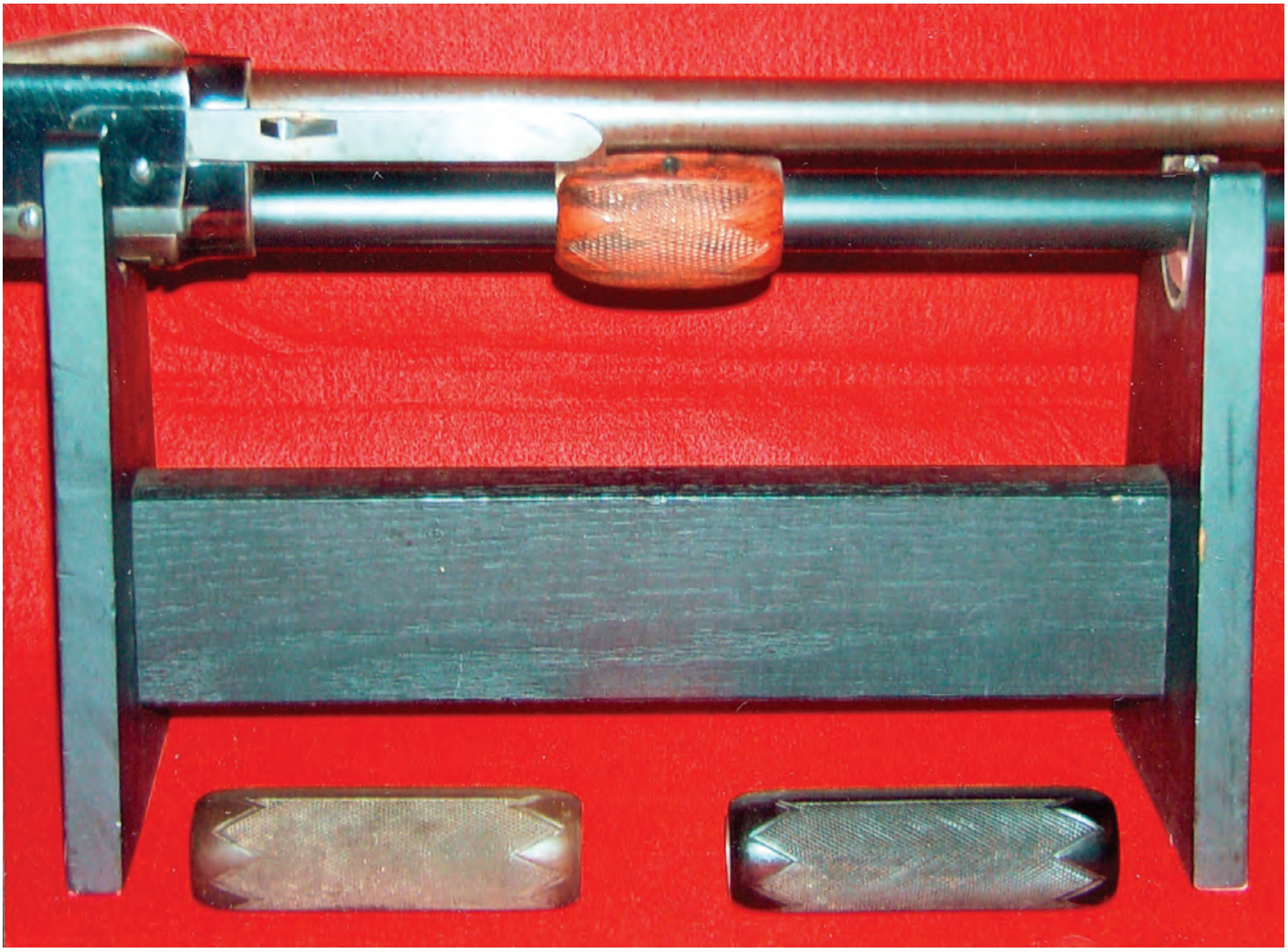

Figure 55. Three hard rubber Spencer shotgun slide handles; the short handle is from the first year of production, 1885, the two longer were for the Model 1890. Bill LaRue Collection.

According to historian Roy Jinks, Smith and Wesson purchased most of their hard rubber grips from India Rubber Company. Despite their company's size, it made sense for Smith & Wesson to purchase from reputable rubber compounders.

On a side note, the late Bruce Skinner was working with Colt doing research on the Lightning revolver and reported finding a letter from The India Rubber Co. referring to prototype "rosewood" grips being completed for Colt.[22]

A fine engraved Iver Johnson American Bulldog with mottled red hard rubber grips from Jim Shaffer's collection is shown in Figure 55.

A mottled hard rubber operating rod cover on a French Mitrailleuse pistol is shown in Figures 56 and 57.

Hard rubber was wonderful stuff. It polished to a high luster and it could be contoured and polished right on the frame, providing an exact and perfect fit with no overhangs or gaps. It was handsome, durable and had enormous customer appeal. Smith and Wesson, Colt and most manufacturers provided hard rubber grips as standard appointments on many of their best grade arms. Engraved and presentation arms were often fitted with ivory grips, but hard rubber was never viewed as "second quality." (Figure 58)

Perhaps Bat Masterson really wanted hard rubber grips on his Colt Single Action.

Figure 59 is a scan from member Frank Seller's book *Sharps*. This is a rarity, an engraved hard rubber side plate on an 1878 Sharps Borschardt.

Companies in the rubber molding business had their own secret recipes and changing suppliers was risky business. Who knew what a new supplier might be changing to reduce costs? No one was willing to talk about formulation or recipe.

My great-grandfather shared his secrets with no one; his formula book was coded with numbers so that no one could look at it and determine what he was doing. The end use applications were listed, but both the ingredients and his suppliers were in code. (Figure 60)

Figure 56. A superb Iver Johnson American Bulldog with mottled red grips. Jim Shaffer collection.

Figure 57. A French Mittrailleuse palm pistol with a hard rubber operating rod cover.

Figure 58. Mittrailleuse mottled red and black hard rubber cover with checkering molded in.

Figure 59. Hard rubber grips were standard on many best grade arms and were never considered "second quality."

The rubber industry was populated with practical men with a wealth of experience. Note the ad on the cover of the June 1883 issue of Science Magazine. In Figure 61, it states that the Superintendent of the Revere Rubber Co. had experience going back 40 years to the beginning of the trade. That's what molders had to offer experience. When it was learned that the Goodyear Rubber Co. had hired a chemist, they became the brunt of trade humor and ridicule. My grandfather remarked, "What would a rubber company want with a chemist?"

Despite all their practical know-how, formulators didn't know everything. You may find a set of grips with white speckles on them. This is "sulfur bloom." The compounder put in too much sulfur, and the excess migrated or bloomed to the surface over time. The speckles don't harm anything, they are easily wiped off. These speckles are rarely encountered on firearms except in static museum

Figure 60. A rarity, a hand-engraved side plate on an 1878 Sharps Borschardt rifle. Most hard rubber components carry the imprints of their molds, few were subsequently engraved. Frank Sellers collection.

displays. We gun collectors tend to be a restless lot and periodically wipe guns down. Any sulfur bloom is then removed. (Figure 62)

Regarding grips that have oxidized from black to a dull brown: Don't buy into Vaseline treatments or impregnation with chassis lube. The surface layer has been compromised and no grease is going to restore it. A brisk rubbing with a non-abrasive polish such as Simichrome or Flitz will remove the outer layer of oxidized rubber, restoring a darker appearance. Be cautious in areas of checkering or fine engraving because this polishing could remove surface detail.

CELLULOID

Cellulose nitrate, or Celluloid (a trade name), was developed as a substitute for ivory and found widespread acceptance as an early moldable plastic. John Hyatt, who pioneered the process of manufacture, also developed the production equipment to make Celluloid a commercial success. Hyatt held 250 patents including those for Hyatt roller bearings. The man was a creative genius.[23]

Celluloid was adopted for use in many molded items including cuffs and collars (Figure 63), fishing reel grasps, dentures and ivory-colored knife handles (Figure 64). It was used in firearms, but not to the extent of hard rubber.

The earliest commercial form of Celluloid was introduced circa 1870 and was prone to shrinkage and easily burned. We have all heard warnings of the fire hazard when storing old "nitrate film." Indeed, cellulose nitrate, in the more heavily nitrated structure of "gun cotton," was known for its flammability and derivatives were used in early smokeless powders. Flammability wasn't really a problem with gun stocks, but shrinkage due to the evaporation of residual camphor or other diluents was a definite problem.[24] Celluloid was sold under other trade names including Pyroxylin, Xylonite, Parkesine, Pasbosene and Pyralin.

Hopkins and Allen and Iver Johnson offered various grip colors including ivory, ruby, carnelian, jasper, coral,

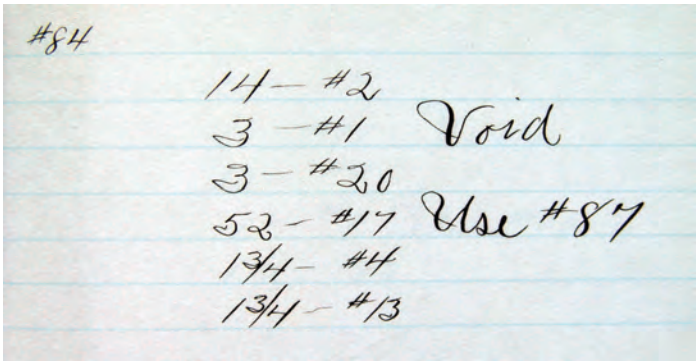

Figure 61. Rubber formulations were highly guarded secrets. This is a page from my great-grandfather's formula book; both suppliers and ingredients are in code.

Figure 63. The little white speckles on this hard rubber button are "sulfur bloom", the result of too much sulfur in the formula. The speckles of sulfur wipe off and are not harmful.

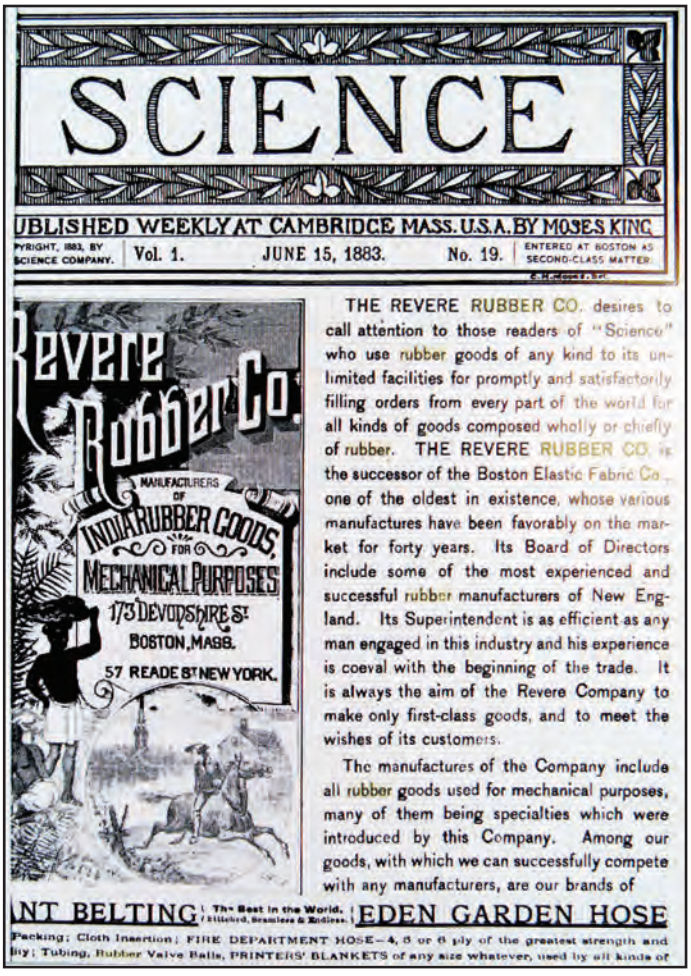

Figure 62. In this advertisement on the cover of the June 1883 issue of *Science*; the Revere Rubber Co. boasts about their great experience. That's what molders had to offer . . . experience.

Figure 64. A trade card for early Celluloid, a trade name for cellulose nitrate. Celluloid was developed as a substitute for ivory and here was advertised for waterproof shirt collars and cuffs.

Figure 65. Celluloid (cellulose nitrate) and later cellulose acetate found widespread acceptance for use in knife handles.

Figure 66. Hopkins & Allen and Iver Johnson supplied revolvers with Celluloid grips in many different colors, here "ivory" and "agate." Jim Shaffer collection.

malachite, agate, pearl and amber. Two examples from Jim Shaffer's collection, Hopkins & Allen Ranger #2s with Celluloid grips in ivory and ruby appear in Figure 65.

Figure 66 is a scan of a page from the July 1887 Merwin, Hulbert & Co. catalogue describing their X.L. Bulldog folding hammer revolver and listing the grip colors available. These colors were vibrant and had to attract attention in the marketplace.

Three colorful Hopkins and Allen grips are pictured in Figure 67. The red is carnelian and the green is malachite. Note the lamination lines in the third grip, ivory; these lines helped imitate genuine ivory. (Jim Shaffer collection.)

One of the hallmark indicators of elephant ivory is the presence of stratification or "grain" lines, often seen in a cross-hatch pattern. Indeed, unique to elephant ivory are these intersecting "Lines of Retzius". Figure 68 is a picture of a billiard ball, an old ivory cue ball, alive with age cracks and the Lines of Retzius.[25]

To provide these lines in Celluloid, manufacturers soon learned to laminate thin sheets of Celluloid with coatings of silver nitrate between the layers. After heating and forming under pressure, this form of Celluloid starts to imitate ivory pretty well. The knife handle in Figure 69, here labeled "French Ivory," is another example of this product.

Imitation became so effective that it is sometimes difficult to distinguish genuine ivory from Celluloid. Early folding "Civil War Era" note pads were genuine ivory and in later years (after 1870) they were manufactured from Celluloid. Discriminating between them can be difficult. (Figure 70)

Remington experimented with Celluloid soon after its introduction in 1869 or 1870 and supplied these synthetic grips on some of their Smoot revolvers. The Remington-Smoot New Model #1 revolver pictured in Figure 71 has Celluloid grips in an ivory color. This image was scanned from the book *Remington Firearms* by Robert Ball. These arms were made from about 1877 through 1888.

Figure 67. Merwin, Hulbert 1883 catalogue lists colors available in Celluloid grips for Hopkin & Allen Bulldog revolvers.

Figure 68. Three Hopkins & Allen Celluloid grips in brilliant colors, note mottled patterns. Jim Shaffer collection.

Remington-Smoot Celluloid grips were normally cast over metal plates, apparently to provide reinforcement. While there was little or no natural adhesion of the Celluloid to the metal, holes in the plates were provided to allow the Celluloid to gain mechanical purchase. (Figures 72 and 73) These grips are often encountered with cracks. It would seem that Remington designers recognized the threat of shrinkage and distortion.

Cellulose acetate started supplanting the use of cellulose nitrate in about 1900 and proved very practical to mold with the advent of injection molding machines. Tennessee Eastman introduced a line of molding compounds based on Cellulose Acetate in 1929 under the trade name Tenite. This product caused quite a stir in 1939 when Stevens, a subsidiary of Savage, introduced Tenite stocks on their Model 530 shotgun. It was light in weight and had flow lines to make the stock look like burled walnut.[26, 27]

In spite of accurate historical resources and the vast "information highway" available on the internet, some inaccuracies persist. Sadly, some are laced with political overtones. Regarding Celluloid, the following quotation appears on the internet page of polymer history offered by the University of Southern Mississippi.[28]

"The very first derivative of cellulose came about when a scientist reacted cellulose, in the form of cotton, with nitric acid. The result was cellulose nitrate.

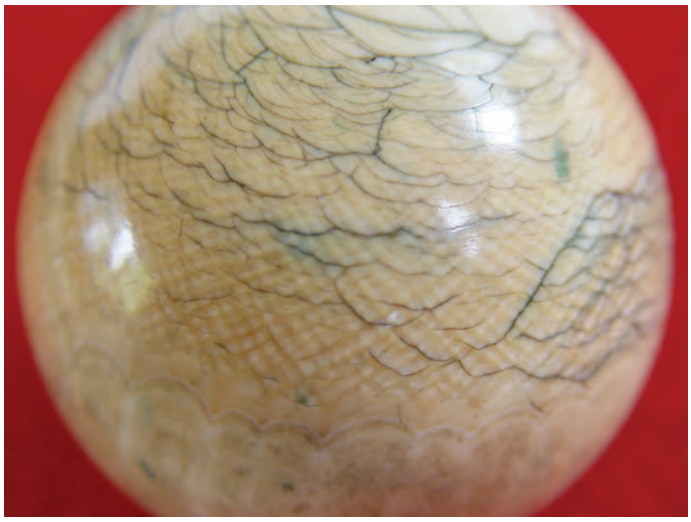

Figure 69. An old ivory cue ball with "Lines of Retzius;" the crosshatch pattern with intersecting lines is indicative of elephant ivory.

Figure 70. A Celluloid knife handle with laminations to imitate the look of genuine ivory, here marked "French ivory."

Figure 71. Civil war "note pads" were initially made of ivory, in later years Celluloid. They look much alike and identification is often difficult.

"Often times, as soon as something is invented, the first thing we do is figure out a way to use it to kill people. Such is the case with cellulose nitrate. Cellulose nitrate, also called gun cotton, turned out to be a powerful explosive. It soon replaced common gunpowder as the explosive charge in the ammunition for rifles and artillery. It worked so well that in the First World War, we were capable of killing ten million people in only four short years.

"In all fairness to cellulose nitrate, it was also used for peaceful purposes. You see, even back then, there was concern that Africa's elephant herds were disappearing far too quickly, and a replacement needed to be found for ivory in billiard balls. . . . (It) was quickly used to make the balls for the world's pool halls. The only problem was every once in awhile one of these would explode during the break." (©2005, Polymer Science Learning Center, Department of Polymer Science, The University of Southern Mississippi) (http://www.pslc.ws/mactest/early.htm)

As with most exaggerations, there is usually a seed of truth. Pioneer John Hyatt humorously told of a letter from a billiard saloon proprietor in Colorado who reported that a billiard ball upon violent contact had produced a report similar to that of a percussion cap causing patrons to pull their guns. Hyatt explained that this was a matter of chemical purity and that it was not a recurring problem.[29]

Celluloid cue balls don't detonate. Nor do Celluloid gun stocks.

Modern cellulosics include cellulose acetate (Tenite), cellulose butyrate and cellulose proprionate. Advertisements for Franzite aftermarket grips (Figure 74) ran for several years from about 1940 right through the 1950s.

BAKELITE AND PHENOLICS

The turn of the century also saw the introduction of phenolic resins, introduced as Bakelite, a phenolic based on the condensation reaction of phenol and formaldehyde. Prior to incorporating reinforcing fillers, such as short fibers of linen or even glass wool, Bakelite was prone to chipping.

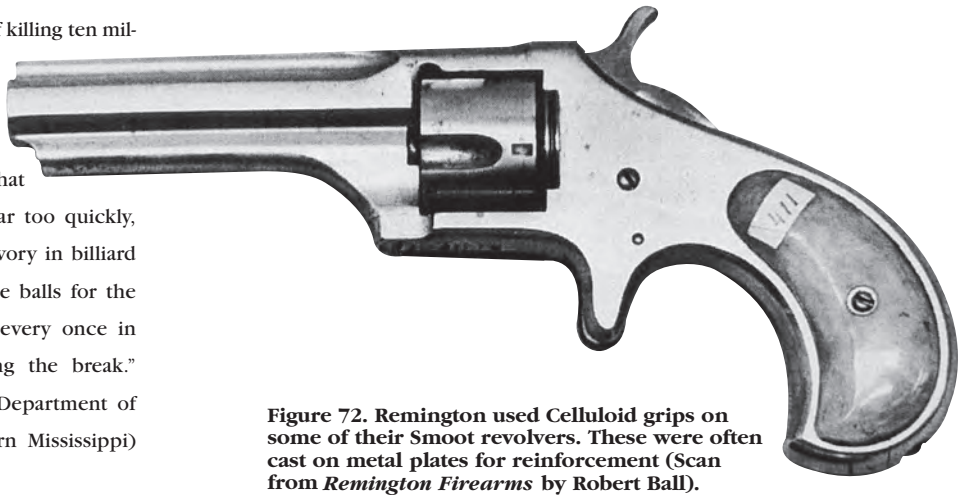

Figure 72. Remington used Celluloid grips on some of their Smoot revolvers. These were often cast on metal plates for reinforcement (Scan from *Remington Firearms* by Robert Ball).

Figure 73. Remington Smoot Celluloid grip with typical shrinkage cracks. Jim Shaffer collection.

Figure 74. Interior of Remington Smoot grip showing the metal plate used to help resist shrinkage and distortion.

Figure 75. Cellulose acetate started supplanting Celluloid in about 1900. Franzite grips of cellulose acetate and derivatives were advertised in the 1940s and 1950s.

Some Remington pocket automatics are found with Bakelite grips which appear identical in design to grips made from hard rubber. (Figure 75)

And Colt obviously experimented with phenolics under their trade name "Coltrock." A bureau canister or "Jarette" from Dick Littlefield's collection is pictured in Figures 76 and 77 and clearly shows Colt's interest in modern synthetics.

Colt introduced their "Coltwood" grips around 1940, near the time when the government started using synthetics in their Model 1911A1 sidearms. To the best of my knowledge, these were reinforced phenolics. I have seen a couple of variations in 1911 grips, enough to make me think that the government was experimenting with alternative compositions.[30]

Announcements in the March 1943 issue of *Field and Stream* states that the new Coltwood grips have sharper and cleaner checkering than wood and offer a more secure grip in the hand. The author states that Colt now boasts what is probably the "largest plastics molding outfit in the world."

What's a test for early Bakelite? Moisten a cotton swab with Scrubbing Bubbles or Formula 409 bathroom cleaner and touch it to the sample. If the area of contact shows yellow, it's Bakelite. I am told that this test will not harm the surface but it would be prudent to test in a concealed area.

The World War II era saw the adoption of reinforced phenolic grips by many countries on many handguns, including the Walther P-38. (Figure 78)

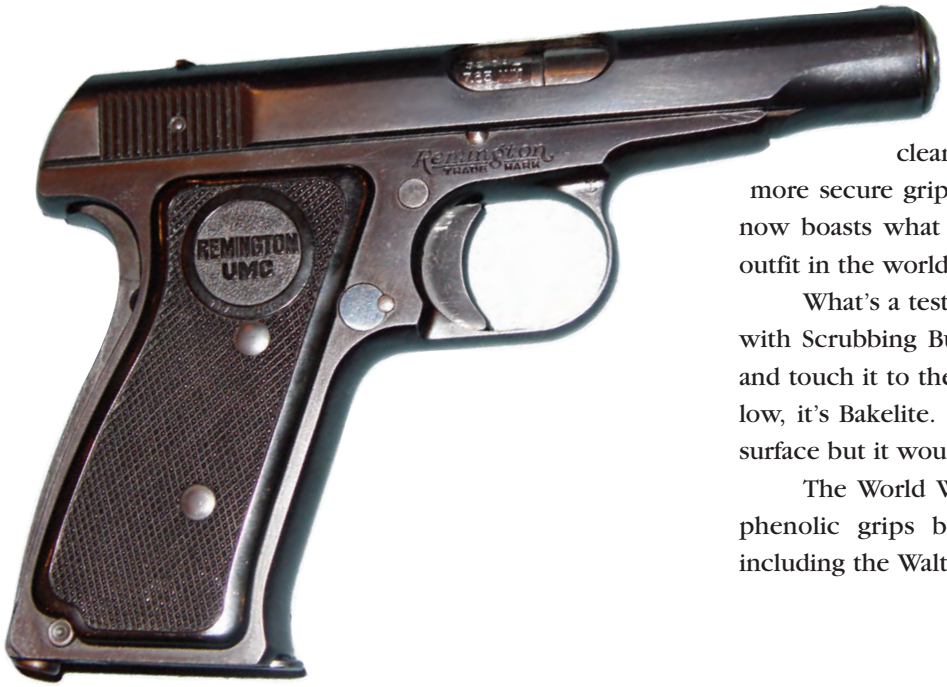

Figure 76. Bakelite was introduced around the turn of the century. Some Remington pocket automatics have Bakelite (phenolic) grips, most are encountered with hard rubber grips.

Figure 77. Colt experimented with phenolics under the name "Coltrock." This bureau canister speaks of Colt's interest in synthetics. Dick Littlefield collection.

Figure 78. Colt's name and rampant colt logo appear on the bottom of this phenolic "Jarette."

Figure 79. World War II saw many manufacturers equipping arms with phenolics. Walther P-38, image courtesy of Rock Island Auctions.

Figure 80. A postwar Colt Woodsman with phenolic grips.

Figure 81. Modern Colt grips, probably a modified phenolic. Modern handguns and rifles utilize engineered plastic frames and stocks, replacing traditional steel and wood.

The postwar Colt Woodsman grips in Figure 79 were a reinforced phenolic.

Colt's use of synthetic grips continues into current production; the Single Action grip in Figure 80 was manufactured in about 2002 and appears to be a phenolic derivative.

The Remington Nylon 66 was successful in the marketplace, and today many target and hunting arms are routinely equipped with impregnated wood stocks or solid synthetic stocks to minimize shift of bullet impact with changes in humidity.

The ultra-modern composites adopted by Glock and so many others for the frames of semi-auto handguns are beyond the scope of this presentation, except to say that traditional and handsome steel frames are being replaced with high performance plastics offering a huge savings in cost and weight.

It would appear that the use of "engineered plastics" will continue to evolve.

My special thanks to Vern Eklund, Dick Littlefield, Jim Shaffer, Bill LaRue, Elliott Burka, Clifford Young, Dave Burghoff, Frank Sellers, Roy Jinks, Stuart Mobray, Pat Hogan of Rock Island Auctions, my son Tom, and so many others who helped dig out information. This is truly a great organization!

I want to express my warm appreciation to my father and grandfather whose conversations at the dinner table provided insight into both the men and the practices in the rubber molding industry.

Notes

1. Franz Clouth, *Rubber, Gutta-Percha and Balata,* D. Van Nostrand Company, 1903.

2. *Encyclopedia Brittanica, Dictionary of Arts and Sciences*, Vol. 11, Werner Co., Chicago, 1894.

3. *Plastribution Ltd.,* Plastribution.hostinguk.com/history.htm

4. Bill Burns, *The Gutta-percha Company*, www.atlanticcable.com/Aticle/Guttapercha/index.htm

5. *Fortune Magazine*, Dec. 22, 2003.

6. *Golfforallages.com*

7. Allan Deutch, *Fitting the Gutta-percha Point*, Endo-Forum, Endo-Mail.com

8. *en.wikipedia.org/wiki/gutta-percha*

9. Elliott Burka, *The American Society of Arms Collectors Bulletin No. 85,* Cadmus Communications, Ephrata, PA.

10. *Wild West Tech,* The History Channel, February 17, 2007.

11. Charles C. Winding and R. Leonard Hasche, *Plastics, Theory and Practice,* McGraw-Hill Book Company, New York and London, 1947, p. 73.

12. *ibid.* p 32.

13. Franz Clouth, *Rubber, Gutta-Percha and Balata,* D. Van Nostrand Company, 1903.

14. *ibid.*, p. 9.

15. *ibid.*, pp. 137, 147, 153.

16. *ibid.*, p. 248.

17. *A Visit to the Cleveland Rubber Company*, Journal of the American Chemical Society, 1896, p.49.

18. Andrea Dragon, *Rubber, Chapter 11*, David O. and Bessie E. Whitten, *Handbook of American Business History,* p. 265.

19. Catalogue, The Hardman Rubber Company, ca. 1895.

20. The NRA Gun Collectors Guide, National Rifle Association, Washington DC, 1972.

21. Andrea Dragon, *Rubber, Chapter 11*, David O. and Bessie E. Whitten, *Handbook of American Business History,* p. 267.

22. Verbal communication, David Burghoff.

23. John H. DuBois, Plastics History USA, *Plastics World*, Cahners Publications, 1972.

24. M. Kauffman, *The First Century of Plastics,* The Plastics Institute, London.

25. www.uniclectica.com/conserva/ivory1.html

26. *Plastribution Ltd.,* Plastribution.hostinguk.com/history.htm

27. Bob Nichols, Cotton Stocking- For Guns, *Field & Stream,* Nov. 1939, p.44.

28. Polymer Science Learning Center, Department of Polymer Science, The University of Southern Mississippi *q* 2005 (http://www.pslc.ws/mactest/early.htm).

29. M. Kauffman, *The First Century of Plastics,* The Plastics Institute, London, p. 35.

30. *Field & Stream*, November 1939.