Typical formulations of blackpowder from various eras are listed below in parts by weight from *The Chemistry of Powder and Explosives.*

Historical Blackpowder Formulations

Source	Saltpeter	Charcoal	Sulfur
8th century, Marcus Graecus	$66^{2}/_{3}$	$22^{2}/_{9}$	$11^{1}/_{9}$
8th century, Marcus Graecus	96.22	23.07	7.69
Roger Bacon, c. 1252	37.50	31.25	31.25
Arderne (laboratory Sample), c. 1350	$66^{2}/_{3}$	$22^{2}/_{9}$	$11^{1}/_{9}$
Whitehorne, c. 1560	50		$16^{2}/_{3}$
Bruxelles studies, c. 1560	75	15.62	9.38
British Government Contract, c. 1635	25	12.50	12.50
Bishop Watson, c. 1781	75	15	10
Typical, c. 1990	75	15	10

Cocoapowder, also known as brownpowder, was an improvement upon blackpowder. The saltpeter content was slightly higher than the best blackpowder compositions (up to 80 percent). It also incorporated a reduction in sulfur content (sometimes to zero). Most importantly, it used brown charcoal (from about 17.6 percent to 20 percent). Partial combustion of rye straw produces brown charcoal, which includes considerable hydrocarbons.

Typical brown powder compositions are shown below from Davis' *The Chemistry of Powder & Explosives.*

Brown Powder Composition

Country	Saltpeter	Brown Charcoal	Sulfur
England	79	18	3
England	77.4	17.6	5
Germany	78	19	3
Germany	80	20	0
France	78	19	3

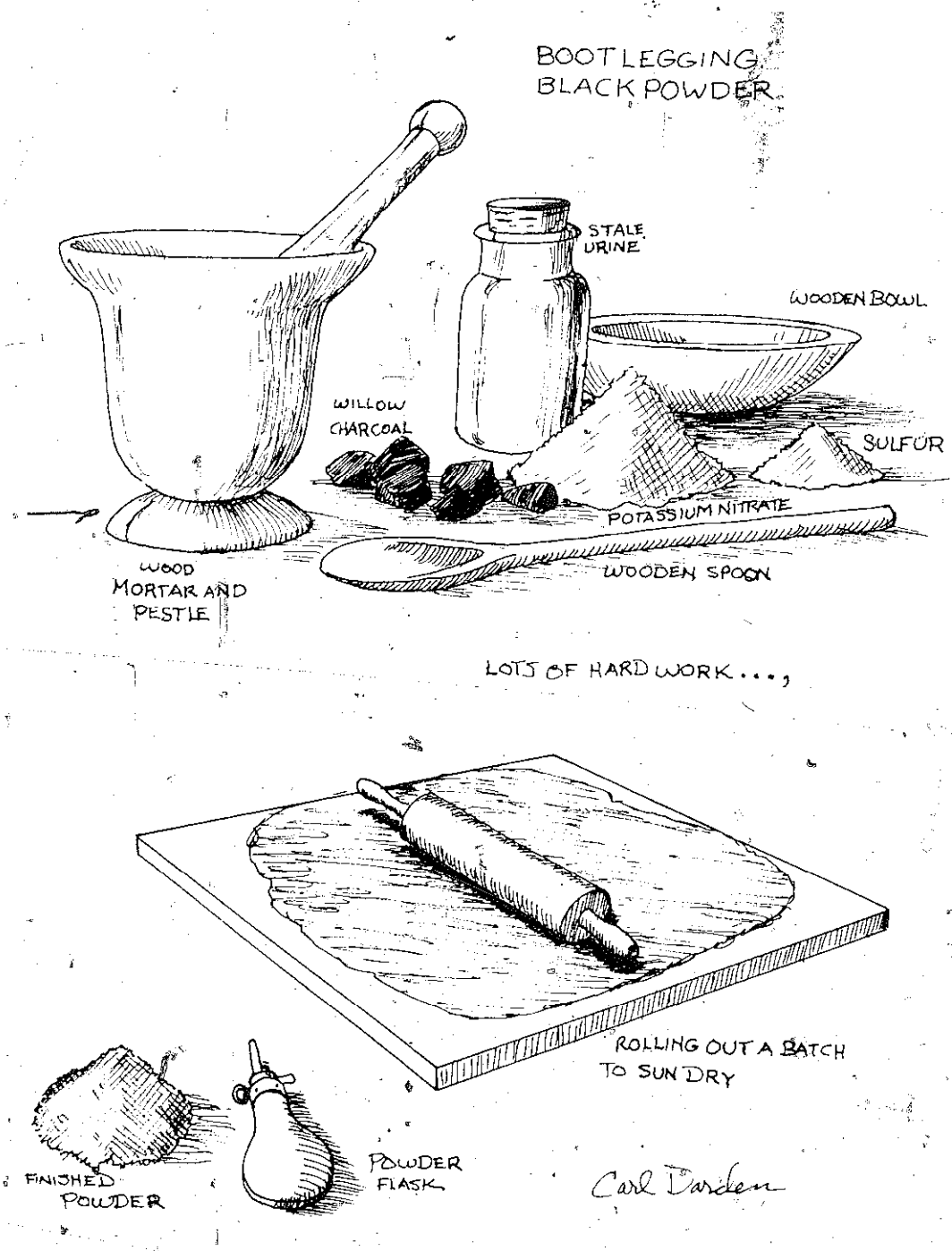

PLATE 199 Drawing by Carl Darden.

quarter of a mile along an old logging road when I heard a sound from around the turn in the road. Easing forward slowly, I could see a nice forked horn buck feeding as I looked through the brush, and he was coming toward me slowly. At the same time it dawned on me that I hadn't loaded the rifle. As quietly and quickly as I could, I began loading the gun. First, I quickly poured a measure of powder down the barrel, then got out a greased patch and ball and proceeded to run the patched ball down on the powder. By this time my hands were shaking. Putting the ramrod back in place, I capped the tube and cocked the hammer. By now the buck was about fifteen feet from me, yet unaware I was a few feet away in a shaky cold sweat. As I slowly raised the rifle to fire, the deer sensed something was wrong and bounded away as my shot went wild. I tell you, I had to sit down and get ahold of myself before I went back to hunting—with a loaded gun this time. So you can get some idea what can happen when hunting with a smoke pole.

"Black powder is and isn't hard to make depending on which end you look at it from. It is a long and tiresome task if you make more than ten pounds at a time.

"Out on the West Coast, as in some southern states, the trend by the government is to prevent its sale with mountains of red tape. Making your own black powder, however, is not unlawful as yet, as far as I know.

"By weight measure, black powder is made of seventy-five parts saltpeter finely ground, fifteen parts charcoal, and ten parts sulfur. All ingredients must be fine ground separately. This can be accomplished with either a mortar and pestle, or with a hand-cranked flour mill. Never mix all three ingredients before grinding unless you want to turn your mill into a deadly grenade, or your mortar into a cannon that can blow off your fingers or even your hand.

"Then the ingredients can be mixed with a small amount of water so the mixture comes out with biscuit-dough consistency. Usually when I mix the ingredients, I add just enough stale urine to make the batch bunch about like biscuit dough. The urine, substituted for water, gives the powder more oxygen and higher performance.

"Flowers of sulfur is ideal for gun powder, and it can be bought in most drug stores in four-ounce bottles or pound cans.

"It can also be found in pure deposits around volcanoes, and in early times, because it was found where molten lava issued from the earth, the sulfur condensed around the rims of the volcanoes was called brimstone.

"Today, in certain places around the world, sulfur is recovered from underground deposits by pumping live steam underground through pipes. The sulfur melts and, being lighter than water, is easily pumped out at another

point close by. Then it is pumped into big ships that haul it to industries all over the world. That's why you can buy a hundred-pound-sack for about three dollars in most places.

"Saltpeter, the chemical that produces the oxygen for the other ingredients when lit off, can be made by putting urine and manure of any kind in a big cement tank mixed with water until you have about three hundred gallons mixed up. Then you put on a tight lid and let it sit for about ten months. You have to have a drain pipe and valve at the bottom, and a stainless steel filter screen installed beforehand or you'll have one big mess on your hands. At the end of that time, you run the liquid that drains off through ashes into shallow wooden trays lined with plastic sheeting and let them stand for evaporation in the sun. When the water evaporates, potassium nitrate crystals (saltpeter) will form in the bottom of the trays.

"In the old days in cities, most outhouses were fitted with trays or drawers under the seats that could be pulled out from behind the building. They had night-soil collectors who were paid so much every month by the outhouse owners to keep those drawers emptied, and they'd come around with a special wagon into which they dumped the contents. When the wagon was full, it was hauled out to where another fellow bought the contents and dumped it into concrete tanks where the bacteria works it just like yeast works wine or bread dough. Then the liquid was run through ashes into shallow tiled or plain concrete evaporating trays or basins to recover the saltpeter.

"Today, saltpeter can also be bought in most drug stores in bottles or cans.

"Charcoal provides the carbon needed when the powder is lit off. When burning, the carbon assists in making potassium carbonates and carbon sulfates during the one-one hundredth of a second that it is burning. Most of this is released at the muzzle of a smoke pole in the form of powder smoke. Some remains in the barrel in the form of fouling and should be swabbed out about every third shot if the shooter wants the round ball to continue to shoot true.

"The charcoal should never be made from hardwood as hardwood has too much ash. Such woods as chinaberry, willow, cottonwood, soft pine with no knots, or redwood and Western cedar make the best grade charcoal. A fifty-five-gallon drum with a snap-on lid and a match-stem-sized hole in the lid set over a fire pit is a good charcoal maker. Take the wood and chip it or cut it into inch chunks and put a bucketful in the drum. Then build a hardwood fire under the drum and when smoke begins to spurt from the vent, light the wood with a match. When the flame goes out, your charcoal is made. Rake the fire out from under the drum, plug the vent with a bit of asbestos fiber or a nail that fits in tightly, and let the drum sit overnight to cook. You can then crush and powder the charcoal with a

mortar and pestle, or run it through a hand-cranked grain grinder to a flourlike fineness.

"By the way, just yesterday I took time out and made a batch of powder, and this time, when I mixed the ingredients, I added homemade alder charcoal instead of redwood and improved the powder's performance 100 per cent. I recently bought a tight little sheet-metal heater stove for camp cooking and by accident discovered that getting a load of alder going good and then closing it up tight and dampering it until it went out and turned cold converted the alder into nice pure charcoal.

"When making black powder, never add any other ingredients or explosive powders unless you wish to turn your muzzle loader into a grenade that can kill you or cripple you for life. Keep your black powder stored in steel, airtight cans in a cool, dry place and out of the reach of children. My parents failed to do that, and I've carried powder marks on my face for the last thirty years. A ten-year-old may think he knows what he's doing, but ten years don't give him enough prudence to think many things out ahead of time before he lights that match.

"The nice thing about shooting black powder is that commercial black costs about two cents a round, and homemade about a half-cent a round. The flintlock is by far the cheapest to shoot. It needs no percussion cap primer—just a flint and primer powder. I'm freely giving the formula because any kid who can read can go into about any library and look it up if he wants it bad enough. And I'm not worried about mad bombers because most of them usually use other types of explosives.

"As far as flints go, sharp-eyed hunters using a flintlock will always keep their eyes open for flint, chert, agate, or hard jasper along river gravel bars and stream beds to pick up and bring home.

"Careful and artful chipping with a small hammer [see Plates 200–201] on a big block of wood with an old railroad spike driven into the center as a small anvil can net a hundred or more gun flints per day once the shooter gains experience in chipping stone. These same flints bought from a sporting goods store will cost from forty to seventy-five cents each. When I make them, I sell them to other shooters for ten cents each. Sometimes I trade flints for lead.

"Seems I've always been able to make good rifle flints for my rifle, and I've had a lot of shooters come and trade a lot of things for them. One fellow brought a goose and traded for fifty flints. I've traded for fresh salmon, crabs, coon hides, outdoor magazines, placer gold, fresh garden produce—one fellow even came and played his guitar for two hours in turn for a dozen flints. Best trade I ever made because he sang all my old fa-