Screening.

The grain sizing system in use in the United States today was first introduced around 1836 as a means of standardizing grain sizing within the industry. These sizes were not universally accepted or adhered to until very late in the 19th century.

Under this standard sizing:

	Must pass through	Must be retained on
Fg	14 mesh	16 mesh
FFg	16 mesh	24 mesh
FFFg	24 mesh	46 mesh
FFFFg	46 mesh	60 mesh

There is something of a logic behind these screen sizes. If one looks at the opening size in these screens and averages each set one will find a mathematical relationship.

If each screen size range is averaged to get a "mean diameter" one finds that the mean diameter of 2F is half the mean diameter of 1F and 3F is half the mean diameter of 2F.

In other words, as one goes down in grain size the average grain size is halved.

This is a way of exercising some control of the amount of surface area per unit of weight in a powder charge in a gun. All the grain sizes come out of the same black powder. There is no difference in chemical reaction rates during powder combustion. Black powder is a surface burning propellant and altering the grain size will alter the amount of time a given charge of powder takes to burn completely.

There are suggestions that the screen sizes introduced in 1836 are not the ones in use today in the U.S. There is a possibility that 2Fg is now 16 mesh to 30 mesh while 3Fg is 20 mesh to 50 mesh. The change is of no importance in the use or performance of these powders.

Other powder manufacturers may work to other standards. The Swiss being a case in point. Little differences in grain sizing does not become significant until one gets into the very fast and very hot burning sporting type powders.

Swiss grain sizing.

U.S.	Swiss	Rough conversion to U.S. Standard Screens.
FFFFg	#1 powder	32 mesh to 60 mesh
FFFg	#2 powder	18 mesh to 32 mesh
FFg	#3 powder	12 mesh to 24 mesh
1.5Fg	#4 powder	12 mesh to 18 mesh
Fg	#5 powder	10 mesh to 14 mesh

In the following data the screen sizes used by the four different powder companies are closely matched.

2Fg powders.

	WANO 2002	GOEX 99NO03B	KIK 00.04	Elephant S-09, 22/00
20 Mesh retained	50%	79.2%	35.0%	39.0%
Thru 20 mesh	50%	20.8%	65.0%	61.0%

3Fg powders.

30 mesh retained	49.0%	70.8%	14.4%	58.7%
40 mesh retained	25.0%	26.2%	42.6%	35.1%
Thru 40 mesh	26.0%	3.0%	43.0%	6.2%

These screen sizes were a way of looking at a particular brand of black powder to see if the powder sample was coarse or fine for that particular grain size designation.

When GOEX had KIK make powder for them in 2000 GOEX specified the screen sizes to match U.S. size standards. But what we see is that the KIK produced to GOEX standards is a good bit finer than GOEX production of the same grain size. Along those lines, the S/A Pernambuco Powder Factory used screen sizes to match U.S. standards for a given grain size designation. This difference has a lot to do with how the plant sets up their corning mill. Should a corning mill have to be rebuilt there is no assurance that it will produce a matching grain size concentration within a specific grain size designation.

Within a particular powder brand and grain size there will be some lot to lot variation in how coarse or fine the powder is for a particular size designation.

The machinery used to sift, or screen, black powder are types commonly seen in other industries. Trammel screens, rotary sifters, etc.

What has changed over the years are the screens themselves.

Very large grain powders were generally screened using heavy sheet metal with round holes cut to a specific diameter.

In the screening of fine-grain powders silk screens were in common use into the early years of the 19th century. These were replaced by brass wire screens which were in turn replaced with stainless steel screens.

Some powder screens were odd sizes. Almost specific to the powder industry. These have generally been replaced by standard sizes used in a wide range of industries. Cost of the screens being a big factor in specific size used.

Silk screens were less than ideal when it came to uniformity of the size of the openings in the screen. Microscope photographs from the screen manufacturers shows how non-uniform silk screens may be since the silk diameter varies considerably.

Brass screens are expensive and have a limited working life. Unless they are washed after use any traces of powder on them will cause corrosion at high humidity. Brass screens also are prone to work hardening and become brittle.

Stainless steel screens are the most durable screens to use. Corrosion is not a problem and they don't work harden. The openings may be cleared with a stiff brush worked over the back side of the screen. With proper care they last indefinitely.

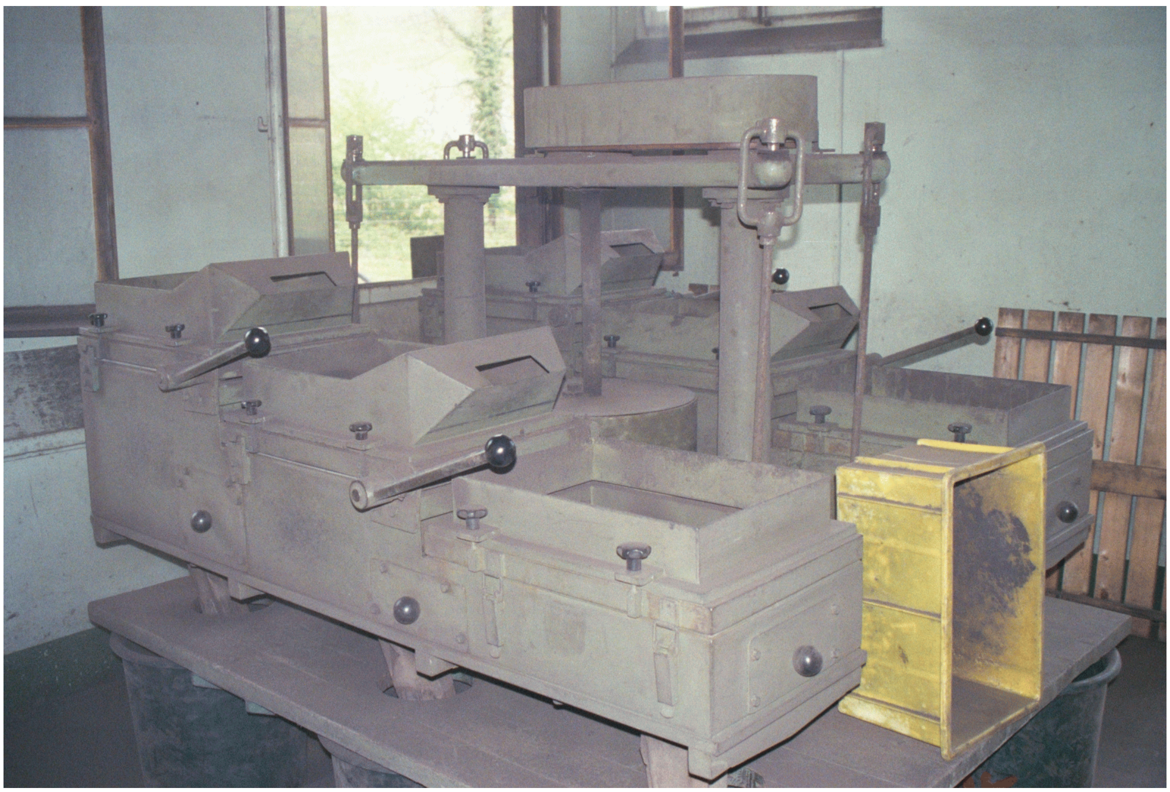

Figure 69. Sifter in the Swiss powder plant.

This is the sifter in use at the Pouderie D' Aubonne S.A. black powder plant in Switzerland. The boxes holding the screens are held by rods from the top of the machine. These boxes are rotated in a small circle rapidly. Each box has three outlet chutes for the different grain sizes being sorted out of the feed. The sorted grain being collected in small barrels under each chute. Clearly this is a hand feed sifter. And again. This plant specializes in small batches of very high quality powder. Pounds per man hour is not a make or break thing as it is in the plants producing large amounts of lower priced powders. Then again this plant was until recently owned and operated by the Swiss federal government where profits were not an issue. Powder quality was the primary production criteria.

Figure 70. A rack of hand screens.

In the same room with the motor driven sifter is a large number of hand screens hung on one wall. As may be seen with the boxes, the hand screens are still being used.

Figure 71. Screens at WANO in Germany.

In this photo we see screens in their storage rack at the WANO black powder plant in Germany.

Their shape suggests another rotary oscillating sifter.

This being stainless steel screening with the screen size opening being noted above each screen in the storage rack.

Graphite coatings on black powder.

There are two misconceptions regarding the function of graphite coatings on grains of black powder.

One common myth is that the small letter g behind the grain size designation indicates that the powder has been graphite coated. The small letter g stands for glazed powder. Glazing and graphite coating are two entirely different things.

When glazed grains of black powder, lacking a graphite coating, are stored for any length of time the mass of grains will begin to clump together. The surfaces of the grains are covered in a thin skin of potassium nitrate and charcoal minerals. These are crystalline materials and will behave as all crystalline materials do. Surfaces of the same salt in contact with even slight amounts of pressure will begin to fuse, or bond, together.

Old military sources describe how kegs of black powder were to be removed from their storage magazine periodically and rolled around on the ground. A little mechanical agitation would break up any clumping without causing damage to the grains.

Graphite coatings on the grains act as an "anti-blocking" agent, preventing the grain surfaces from fusing, or bonding, together.

An old duPont Blasters' Handbook states that graphite is used where a free flowing powder is desired.

Graphite coatings on grains of black powder do not provide any form of moisture protection when the powder is subjected to humid air. The graphite will only hide the effect of additional moisture pickup by the powder.

Heavy graphite grain coatings are a way of hiding the effects of the use of an impure grade of potassium nitrate in a powder.

Some black powder plants add graphite to the powder after corning but prior to the screening of the powder. The graphite acting as a screening aid to increase the rate at which the grains will pass through the screens.