

**Build This...****1/2" I.D. Saxons**

by "Big G"

**Summary:**

Saxons are among the easiest spinning effects to create and will make an ideal project for those just getting started in pyrotechnics. These classic devices have been around since the early days of fireworks, and are surprisingly effective for their small size and simplicity. This article describes how to make several different saxon configurations that can be turned out in only 10 to 15 minutes!

Formulas: [Gold 1](#), [Gold 2](#), [Silver](#),

Materials:

- ▶ Convolute Tube, 7 in. long, 1/2in. ID, 1/8 in. wall.
- ▶ Black Match
- ▶ Tissue Paper
- ▶ white glue
- ▶ powdered clay
- ▶ 30# kraft

Tools:

- ▶ 1/2" Spindle and Dowel
- ▶ Non sparking mallet
- ▶ Small brush
- ▶ Drill press or hand drill
- ▶ 5/32" drill bit

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Saxons



Figure 1: A single action saxon, driven from one end only.

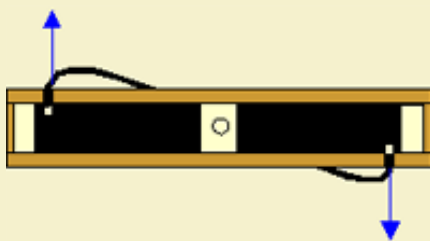


Figure 2: A double action saxon driven from both ends.

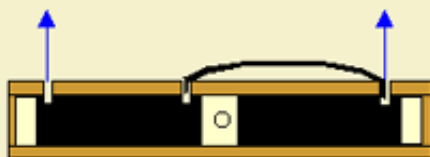


Figure 3: A reversing single action saxon. The end of the first stage ignites the opposing second stage.

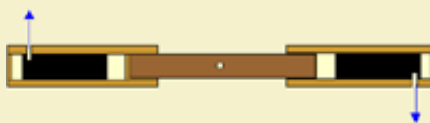


Figure 4: Larger saxons created by connecting single drivers to a center piece (usually a wood stick).

Introduction:

Saxons are a very old fireworks piece that have been documented in many of the classical fireworks texts, including the works of Lancaster, Weingart and Kentish to name a few. In its simplest form, the saxon is a single driver that rotates around a pin driven through the center of the driver tube itself. A distinguishing feature of saxons is that they are driven from hole drilled in the side of the case instead of through the end. This results in a force perpendicular to the long axis of the case, allowing it to easily spin around a pivot point created anywhere along the length of the case (typically the center point). The simplicity of this design allows attractive pinwheel type devices to be easily made without the need for wooden or plastic hubs to hold the drivers. While not quite as impressive as a wheel, saxons can be assembled in 10-15 minutes, making them a quick fix when one hasn't "smelt the smoke" in a while.

Saxons may be driven from one or both ends of the case, and color pots are often attached for enhanced effect. Saxon type devices are also commonly used as shell inserts, sometimes alternately called whirlwinds, creepers or tourbillions. When used as a shell insert there is no pivot point of course, so no hole is drilled through the case.

Figure 1 shows the simplest type of saxon, which is driven from only one end. In this illustration half of the case is charged with clay to act as an inert counter weight. It is actually possible to charge the entire case and then hammer a small nail right through the case and comp without effecting the performance of the saxon, although some may not be comfortable driving nails through live composition.

Figure 2 shows a saxon that burns from both ends, resulting in more spark output and higher RPMs. The two opposing holes must be fused together with a piece of piped match so that they ignite simultaneously.

Figure 3 shows a reversing saxon, which is similar to a double saxon only the second exhaust hole is on the same side of the case as the first, and it doesn't take fire until the first driver is finished. A third hole at the end of the first drivers charge is used to pass fire to the second driver. The effect is a spinner that ramps up to speed, then starts slowing down, stops and finally begins picking up speed in the opposite direction.

Figures 1-3 are simple saxons that are built from only a single casing. When a larger saxon is desired, it is more common to build the two drivers separately and connect them with a wooden center piece such as a dowel rod, as seen in Figure 4. Each driver is rammed such that there is a cavity above the end plug that is deep enough to slip snugly onto a dowel rod.

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Figure 5: Rammer and Spindle. The depth marks are 1 cm (3/8 in.) apart..



Building a Single Saxon:

The simplest saxon is a single driver saxon. Half the case is charged with the driver composition, while the other half is filled with clay to act as a counter balance. The clay extends a little beyond the center point by about 1 cm (3/8 inch).

A simple set of tools can be made from a scrap of wood and a 1/2" dowel rod. First we make a half inch spindle by taking a 4x4 inch wood piece and drilling a hole in the middle of one of its faces half an inch deep. Then a short dowel, about an inch high is glued into the hole. Another piece of dowel, made from wood, brass or stainless steel is used as the rammer. The rammer is drawn with depth marks as seen in Figure 5. Note the centimeter marks on the dowel. When loading, these markings allow us to know how much composition was already placed inside the driver.

The driver being loaded in Figure 6 is half inch ID and 18 cm (7 in.) long. It was made by dry rolling a sheet of manila folder paper (or European 280gms paper) measuring 18cm x 20cm (7 in x 8 in.) around a 1/2 inch diameter rod. The last half inch was covered with white glue diluted with 50% water – and it was overlapped by a sheet of 30# kraft measuring 18cm x 10cm (7 in. x 4 in.). The rectangle was covered with diluted white glue except for the first few inches.

The tube is first loaded with a clay plug about 1/2" thick. Next the driver fuel is charged in small increments. Before loading the comp, it is best to drill the exhaust hole just above the clay plug first. This will relieve you from having to drill through live comp, and also allows you to pre-install the fuse and ram the comp down on top of it, thus locking it in place. The exhaust hole should be about 1/3 of the size of the driver ID. Thus our 1/2 inch ID driver should have a 1/6 inch hole, which translates to about 5/32" for standard bit sizes.

After drilling the hole, insert a piece of black match about half the length of the driver into the hole. The driver composition is now loaded in increments that compress to about 1/2" each until the tube is filled about 3/8" shy of the midpoint. Marking the midpoint on your ramming rod plus another mark 3/8" above and 3/8" below this point will help when ramming saxons.

The remainder of the case is now loaded solid with powdered clay, which acts as an inert counter weight so that the saxon will not have to work as hard to spin around the center point.

In order to secure the fuse against the casing and protect it from getting battered during storage, a few turns of tissue are wrapped around the end as seen in Figure 8. Some glue is brushed on the casing, being careful not to get any on the fuse or in the area where the fuse will come in contact with, then the tissue is wrapped around it. Keep in mind that this tissue will act as quick

Figure 6: - Saxon filled with clay up to the mid point. The depth mark shows 7.8 cm (3 in.) from top..



Figure 7: After loading and fusing the saxon, glue is applied around the fused end to secure the nosing paper.



Figure 8: A completed single drive saxon. Note that the driver hole runs perpendicular to the spinning axis hole.



Figure 9: Washers used to space the saxon away from the launching stick, thus avoiding contact during operation.

match as soon as the fuse burns up to it, so be sure there is enough bare match exposed to give you ample get-away time after ignition!

The last step is to drill the pivot hole at the center of the case. This needs to be drilled in the middle of the driver through both walls and clay, perpendicular to the driver hole. The diameters should be just slightly bigger than the pin you plan to mount the saxon on.

Firing the Saxon is similar to firing a wheel. It can be a simple matter of driving a nail through the Saxon hole and onto a wooden pole 2 meter high. However, such a method tends to be problematic as the Saxon hits the wood while rotating. The nail head can also dig into the tube and slow it down. An improved setup is shown in Figure 9. The driver sits between large zinc washers that prevent it from contacting both the wood and the nail head. The nail is not hammered in too deep, so the discs and Saxon sit loosely on the nail. The discs are smooth enough to create very little friction and allow the Saxon free movement.

Design Notes:

Unlike end burning drivers in which the exhaust hole is drilled into clay, the exhaust hole of a saxon is drilled into the driver's wall. This means that fire eats through the paper and makes the hole larger and larger during the display. This causes the saxon to gradually slow down and, if the hole becomes too large, can ruin the effect of a continuous circle of fire.

There are a few ways to solve this problem. The first is to use a faster burning composition that does not burn hot or long enough to erode the hole much. The most common compositions for saxons are based on meal powder, which burns cooler and quicker than most color compositions involving barium nitrate or potassium perchlorate. When color saxons are desired, then a thicker walled tube must be used to accommodate the increased hole erosion.

Another alternative is to use a conical end plug such as the type used when making tourbillions. This requires a tapered rammer to make the plug, then drilling the exhaust hole such that it passes through the thin wall of protective clay left by the taper. When making double saxons with conical plugs, the drivers would have to be made separately and connected by a wooden dowel as shown in Figure 4.

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Figure 10: Fusing a double action saxon with piped match.



Figure 11: Finished double action saxon.

Double Saxons:

Double Saxon is still constructed using a single driver, except this time the entire driver is loaded with composition and the exhaust holes are bored at both ends. The tube will be mounted onto the spindle and loaded in the following order:

- 1) 3/8" of clay for end plug.
- 2) Composition up to the middle point minus 3/8".
- 3) 3/4" of clay.
- 4) Composition up to 1/2" from the top.
- 5) 3/8" of clay for end plug.

Double Saxons can be ignited using a "single stage" where both ends fire simultaneously (see Figure 2) or "two-stage" ignition where one side of the Saxon finish burning before the other end starts (see Figure 3).

Commercial outfits typically use two separate drivers that are pasted together to form the double Saxon (see Figure 4). This allows the manufacturer to utilize the same machines that load fountains and drivers to load saxons as well.

Building a Single Stage Double Saxon Begin building the saxon just as you would the single saxon described previously, except the black match used to fuse the hole needs to be long enough to reach the opposite end of the saxon. When the driver comp is rammed to 3/8" shy of the center point, only charge 3/4" of clay above it. Driver comp is then rammed above the central clay plug until within 1" of the top.

At this point you can drill the second vent hole 5/8" from the end of the tube, making sure that it points in the opposite direction as the first hole. While you could drill both holes before loading any composition, it can be hard to get the rammer past a pre-drilled hole, since it tends to cave in the tube wall slightly.

After drilling the second hole, ram more composition until the tube is filled level with the new hole. Now slip a piece of loose fitting quickmatch pipe over the blackmatch extending from the first exhaust hole, then insert the other end of the match into the second exhaust hole (see Figure 10). Ram another increment of driver comp so that the tube is filled to within 1/2" of the top, thus locking the black match in place. Finish by ramming the final 3/8" plug. Use tape to secure the connecting piped match to the driver so that it doesn't obstruct the area where the central pivot hole will be drilled.

Take another stick of black match and slide it into either end of the connecting piped match. This will be the ignition point for the saxon, and all it needs to do is ignite the piped match at some point (which will immediately ignite both ends of the saxon at once).

To give the Saxon that extra touch and good look – one can paste a Kraft #30, covered with 50/50 glue/water mix over the quick fuse casing and tube (but not over the exposed black match tips or the jet holes) and then use the same trick shown in the construction of single Saxons to cover and secure the fuses with tissue paper. Figure 11 shows the complete Saxon ready for storage and display.

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Building a Two Stage Double Saxon

Starting with the same procedure used to build a single stage Saxon, we repeat the steps up to and including the central clay plug. We now take the Saxon off its spindle and drill 2 holes. The first hole will be 3/8" above the plug and oriented to oppose the direction of the first exhaust hole. The second hole will be 5/8" from the top of the tube so that it is in line with the first hole. This second hole may be drilled later after the comp has been rammed close to the end so that you will not have to slide the rammer past the dimple made on the inside of the case when drilling the hole.

Now take the bottom fuse and place a segment of quick match pipe over it. Push the other end into the middle hole and consolidate an increment of composition onto it to hold it in place. Keep on filling the Saxon with composition until you are par level with the top hole. Insert another fuse to this hole and consolidate your last increment over it. Plug the top with some more clay.

To finish the Saxon off, use the pasted kraft paper or foil tape to hide the quick match and make sure you cover all of the fuses holes with tissue paper. Failure to protect the passfire match can result in premature ignition of the second stage.

Upon ignition of the fuse near the top of the Saxon, the composition will burn with one type of composition until it reaches the mid point of the Saxon. Then the second fuse will ignite, and as the fire from the first jet hole dies, the second jet hole will spring into life with a different effect altogether.

The ability to mix to different effect into one Saxon makes this the most lovely of Saxons. Try to filling both halves with different compositions for an attractive effect.

Design Notes:

Note that the reversing saxon shown in Figure 3 is a two stage double saxon built as described above, with the only difference being that all holes are drilled on the same side of the tube. This causes the second stage to spin in the opposite direction as the first stage.

It helps not to drill all the holes at the beginning before loading any composition. The reason is that drilling into the tube causes it to "cave in" and makes it hard to slide the rammer in and out easily. Also, some composition tends to escape out of the open holes. Therefore, I prefer to drill the holes as late as possible during assembly.

Saxons are easier to construct than related effects such as wheels, and they take only minutes to crank out if you have all the compositions on hand. However, the maximum number of effect you can put into a saxon is more limited than wheels or other complex rotating pieces. Saxons are driven by one or two jet holes at most. This means that there is a limit to how much power can be allocated for "pushing" the saxon and this limits the amount of external payloads that can be attached to them (such as color pots, whistles etc.). The fact that the exhaust hole widens with time means that the pushing pressure drops as burn time progresses, whereas this is not a problem with wheels driven by end burning drivers.

Saxons look best as a part of a larger effect. In Victorian times they were used in conjunction with large lance pieces to provide animated effects such as rotating wheels on chariots. Even today, igniting a few saxons together with large fountains in between is an impressive effect. In my house, they are still the most popular wheel around! 🔥

