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# TURBO *Pyro*

## 10 FIREWORKS YOU CAN MAKE THIS WEEKEND

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**by Ned Gorski**

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**CAUTION**

The experimentation with, and the use of pyrotechnic materials can be dangerous. It is important for the reader to be duly cautioned. Making fireworks is inherently dangerous. Serious injury or even death can result from any number of causes, sometimes beyond the user's control. Before proceeding with these projects, be sure that you are willing to undertake these risks.

This book is dedicated to the members,
past, present, and future of

The Pyrotechnics Guild International

who have contributed so much, for so little,
to the art, craft, and science
of fireworks making.

and to

Big Nancy

for making it all possible.

# Preface

There has been a need for some time for people who are just beginning their pursuit of fireworks-making, to have a simple, logical, and practical starting point, one which enables them to quickly succeed and be encouraged by their pursuits, without overly endangering themselves or those around them.

This book is designed as an introductory text to enable the reader to accomplish just that. It serves as a practical workbook to be used in making the different types of fireworks described herein. The publisher owes a debt of gratitude to all who have come before in writing about fireworks. They are too numerous to list here. Suffice it to say this book stands on the shoulders of all who have written, taught, demonstrated, or simply shared their knowledge of pyrotechnics and fireworks making. Without them, this book would never have been written.

Everything in this book has been tested. All of the formulas, procedures, techniques, tools, chemicals, and so on have all been used in the projects described herein. They all work if you use the materials and methods prescribed. Yet, these projects are basic and simple enough, that although the reader may inadvertently stray from the instructions given here, it is still entirely possible to end up with a successful firework.

That being said, we don't advise it. You will be best served, both from a safety and personal satisfaction standpoint, if you will stick to the instructions. Doing so not only maximizes your chances of success, of having your fireworks turn out right, but will also enhance your knowledge.

The thing to remember is that this book is a teacher. It has been designed to teach you to make fireworks. If you have never made fireworks before, and if you successfully complete all the fireworks projects in this book, you will be well on your way to learning the art, science, and craft of fireworks making.

But this book can never convey everything necessary for you to become a master of the elusive craft of pyrotechnics. That might take a lifetime of study and practice, mostly the latter.

What Turbo Pyro can do is get you started on a solid footing, using tried and tested methods, with relatively safe projects. If you learn these projects, you will have a good foundation in fireworks making.

It is my hope that you truly enjoy these projects, that you make and use them safely and legally, and that you want to continue forward with this incredibly satisfying and creative pursuit.

We welcome your suggestions and critiques of this book. If you find any typos or errors, please let us know.

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# Contents

# Chapter 1: Using Turbo Pyro

## How to Use Turbo Pyro

Turbo Pyro is a unique book. It is designed to be used in two ways:

- Printed
- On your computer.

Here's how it works. First print the whole book out and either put it into a binder or have it ring or spiral bound. This will become the workbook that you will use in your manufacturing area.

Keep the downloaded PDF file on your computer. You will need to use that document to view the many video segments of contained in this book. (It's also your backup in case you need to print the book again.)

To view the videos, you will need two things:

Adobe Flash Player: You will need to download and install Adobe Flash Player, version 9.1 or later on your computer. You can get it here free from Adobe: http://www.adobe.com/products/flashplayer/.

An Internet Connection: When you play the videos, they actually "live" on a fileserver somewhere else. They are not on your computer, nor in the Turbo Pyro document. Therefore, you'll need to have your computer connected to the Internet when you click on a video to play it.

## What Is Turbo Pyro?

Turbo Pyro is an accelerated program designed to have you learning a broad range of fireworking skills, and making the associated devices in no time at all.

Ten unique and varied types of fireworks will be focused on in a comprehensive and detailed manner in one chapter each.

Right below the name of each chapter and project, you'll see how many devices you can make in that project, like this:

Chapter 5 How to Make Flying-Fish-Fuse Mines (Make 10 Flying Fish Mines)

Enough supplies have been provided in the Turbo Pyro Kit for you to be able to make exactly that number of finished fireworks.

You'll notice that each how-to chapter begins with an overview of a particular device or component, and a "Quick Start" section, which outlines the steps involved in making that device.

Then, "Detailed Instructions" will take you through the individual steps involved in making that device. Some varieties of the device will occasionally be discussed, and at the end of the chapters, more advanced projects will be described.

These are small projects. In fact, they are about as small as you can get in homegrown fireworks making. They are roughly the size and scale of consumer fireworks. The individual projects you will be working on are designed to be small, backyard scale fireworks, suitable for displaying anywhere it would be safe and appropriate to fire consumer fireworks.

The small, simple fireworks projects can lead to larger and more complex projects, though, once you've mastered the basic skills taught in Turbo Pyro.

Turbo Pyro is designed to not only enable you to make many devices, and a wide variety of them, but to learn many basic fireworking skills which will serve you for a lifetime in the hobby and art that is Fireworks.

## Ten Types of Fireworks Devices You'll be Making

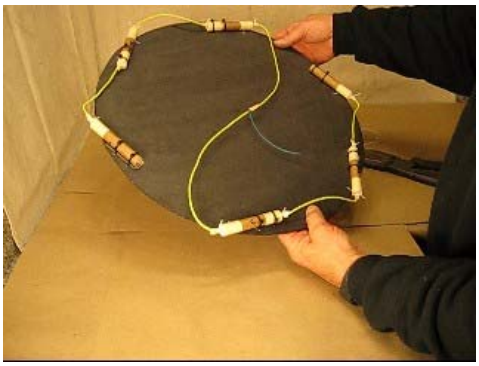
Turbo Pyro is going to take you, one step at a time, through the process of making the following ten basic types of fireworks:

**3/8-Inch Pumped Stars and Star-Mines**


**Flying-Fish-Fuse Mines**

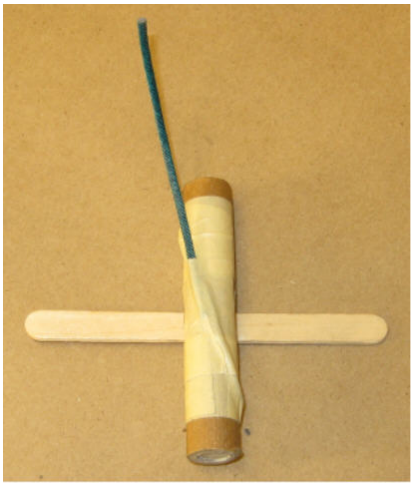

**Silver-Spark Tube-Sparklers**


**Orange-Spark and Silver Fountains**

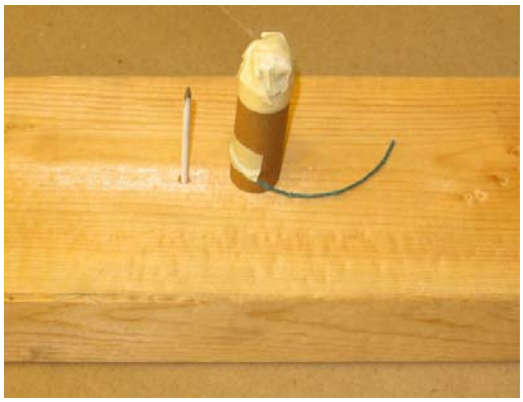



**Color-Changing Wheels**

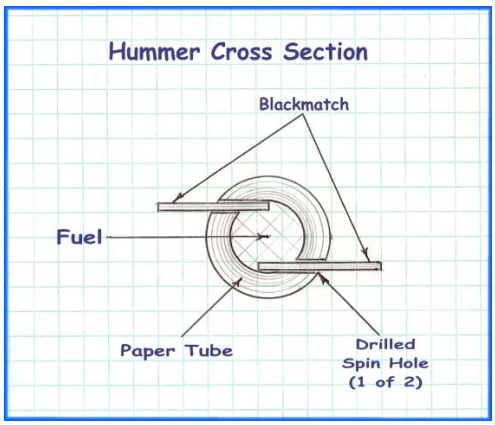

**Magnum Bottle-Rockets**

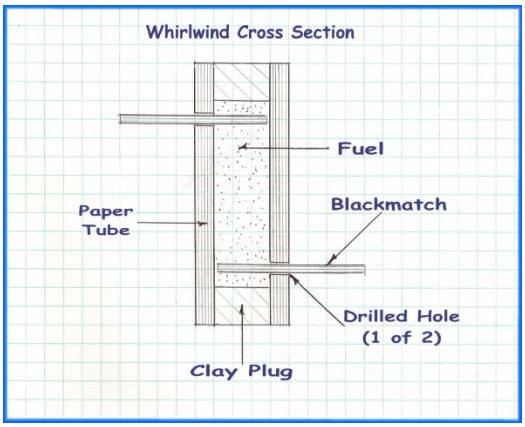



**Helicopters**




**Stinger Missiles**




**Hummers and Whirlwinds**


**Festival-Ball Aerial Fireworks Shells**

## Where Do You Begin?

We'll show you exactly that, step-by-step.

In Chapter 3 you'll be directed to collect some everyday tools, supplies, and safety gear. You'll already have some of these items on hand, and the rest are readily available from local stores such as Wal-Mart.

You'll need these supplies to successfully and safely accomplish the tasks that you are about to embark on.

We'll also take a look at what is necessary to create the spaces necessary to work safely on these projects, to dry the compositions and devices, and to store them safely and securely once they are done.

Note: Safety information is the easiest type to simply gloss over and ignore. And it is the information, which can keep you from serious accident, injury, property damage, legal problems, and death. Take the safety sections seriously. You can only have fun in this art if you practice it safely, and you don't want to learn the safety lessons the hard way.

We, who are offering this information, feel a responsibility to you, who are going to use it. If you do not take certain safety precautions seriously, this work in pyrotechnics can:

- Cause great physical harm if it is not done safely
- Harm you and yours physically
- Damage your home
- Ruin your marriage and family

Here are links to the safety stories from two PGI Grand Masters with years of experience under their belts.

One story deals with a fireworker who burned himself alive and begged to be allowed to die. The other tells of one of the Grand Masters almost doing that to himself, and what he does now to prevent it.

http://www.skylighter.com/fireworks/safety-articles.asp.

In addition, you can download an excellent article, Fireworking Safety, the Law, and You, which contains an excellent project on making an indoor magazine.

Chapter 2 will describe the various specific pyrotechnic supplies, chemicals and tools that will be needed for these Turbo Pyro projects. You will be told the quantities of each supply that you will need to make the numbers of devices, which are specified in each project.

And, once you have ordered your pyrotechnic specialty supplies and you are waiting for your order to arrive on your doorstep, we'll give you a little project to be working on:

The Wheel Project requires that you prepare and assemble a simple frame on which your pyrotechnic components will be assembled. You can be working on this wheel frame once you've set up shop and while you are waiting for the pyrotechnic supplies to arrive.

And, then, in Chapters 5 through 15 we'll actually get to work on the specific fireworks projects and devices.

You will find that you get your best results if you follow these projects in the order they are presented. That's because the projects build on each other. What you learn and make in the early projects will often be used in the later ones. For instance Fountains are also used later as drivers in the Wheel project.

But, Chapter 7 describes a basic black-powder base mix, which will be used in many of the projects. And, the first part of Chapter 6 teaches you how to make 3/8-inch pumped stars.

These two components have to dry for a day or so before they can be used in the projects, so it's a good idea to begin by tackling those two components and getting them in a safe area to dry completely.

While they are drying, the projects in Chapters 5 and 8, "Flying-Fish-Fuse Mines" and "Tube Sparklers" do not need to use base-mix or stars to be completed.

So, after making the base-mix and the stars, you can get right to work on those two projects while your components for later projects are drying.

# Chapter 2: Pyrotechnic Supplies You'll Need for the Turbo Pyro Projects

Now that you've decided to tackle Turbo Pyro, here is a list of the special pyrotechnic supplies you'll need to make these projects. You can't find these supplies at Wal-Mart. And most of them are not available locally at all.

So, you will almost certainly have to order them from a reputable pyrotechnic supply company. You will probably find the most economic approach will be a complete kit containing all the supplies listed below from www.Skylighter.com.

But wherever you get your supplies, make it your first order of business to order them right away. They can take one or two weeks to arrive, so you might want to order right now.

You'll also need some fairly common household supplies and tools. There's a complete list of those items in the next chapter.

The list below contains all the pyrotechnic chemicals, tools, and supplies used in the various projects in this book.

The total quantity you'll need of each item is shown. And there is a link to that product if you want to buy it from Skylighter.

Keep in mind that if you need all of the items below, it's more economical to buy them all together in the kit, than to purchase each one individually.

The price of the Turbo Pyro Kit is a fraction of what the individual items would cost if you bought them separately from anywhere.

## Pyro Tools & Supplies Needed for Turbo Pyro Projects

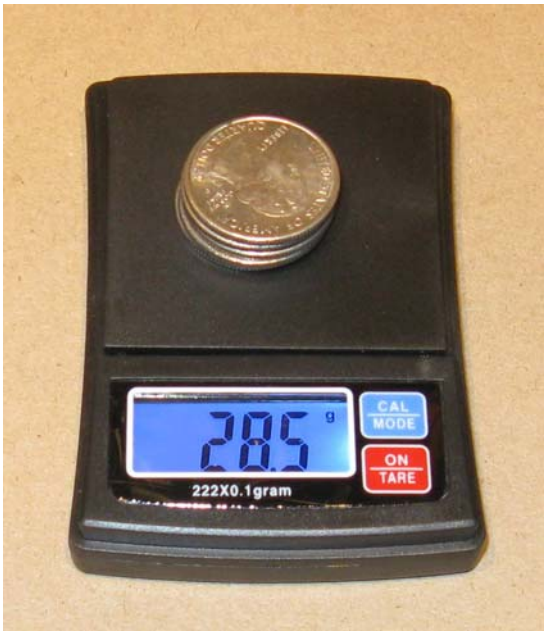
The following list of tools and supplies are provided in the Turbo Pyro Kit that you can buy from Skylighter. This is all of the special pyro supplies, tools, chemicals, fuse, tubes, etc. in the exact sizes shown in the project instructions that are needed to make all of the projects in this book.

### Digital Scale

The scale weighs up to 222 grams (about 8 ounces, 1/2 lb.), has 1/10 gram accuracy is Backlit LCD Display, and weighs in grams (g), ounces (oz), or penny weight (dwt). It also has a tare function. This scale comes with batteries already installed 3-1/2" x 2-38" x 5/8" thick. Skylighter # TL5020. Quantity needed—1

It is a good idea to keep a known weight in your shop to check the accuracy of your scale each time you use it. The batteries can get low, or the scale can start to fail, and the result will be inaccurate weighing. Five US quarters typically weigh 1.00 ounce (28.4 grams), and nickels weigh 5 grams each typically.

Keep a few quarters or nickels, of known weight, in a plastic baggie so they stay clean. Check the accuracy of your scale each time you use it. That simple precaution can prevent a lot of weighing mistakes.




**Checking Scale Accuracy**

When you are weighing chemicals, place the mixing tub, into which you'll be putting your weighed chemicals, next to your scale.

Place an empty paper cup on your scale. Push the scale's "tare" button to set the scale to zero with the weighing cup on it.

Put the desired amount of an individual chemical in the cup on the scale, and then dump that chemical into your mixing tub.

Repeat that with each individual chemical, until all the individual chemicals have been weighed and are in your tub.

Now put another container, large enough to hold the weighed mixture, on your scale and "tare" the scale to zero again.

Pour your chemical mixture into the empty container on the scale and verify that the mixture weighs what your total batch was supposed to weigh.

That verifies that you have not forgotten a chemical, and you have weighed each individual component accurately.

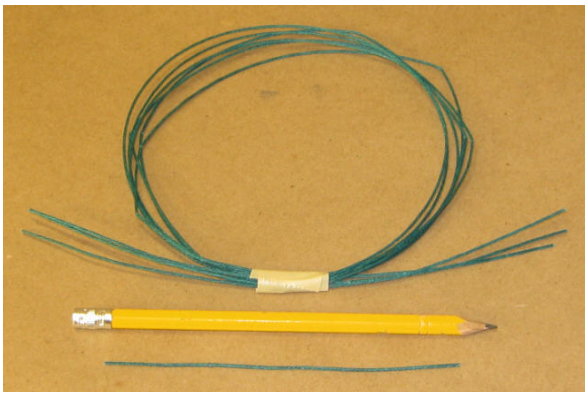
You are now ready to proceed with the other steps in mixing your composition.

Note: A digital scale may continue to “tare” after the button has been pushed, and while small quantities of chemical are added to the cup. You can add a gram or two of chemical to the cup and the scale is still displaying 0.00. It is best when weighing very small quantities of chemicals, to tare the scale to zero with the cup on it, remove the cup and add a bit of the chemical to the cup while it is removed from the scale. Then put the cup holding the bit of chemical back on the scale and adjust the amount of chemical as necessary.

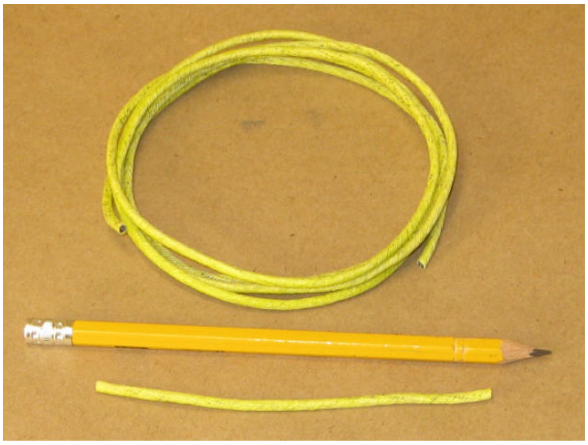
## Fuses

Chinese Visco ignition fuse, 3/32-inch diameter. Green fuse, burns at about 1.7 seconds per inch. Skylighter #GN1005. Quantity needed—50 feet

Thin Chinese Visco ignition fuse, 1mm (3/64-inch) diameter. Green fuse, burns at about 5 seconds per inch. Skylighter #GN1010. Quantity needed—3 feet

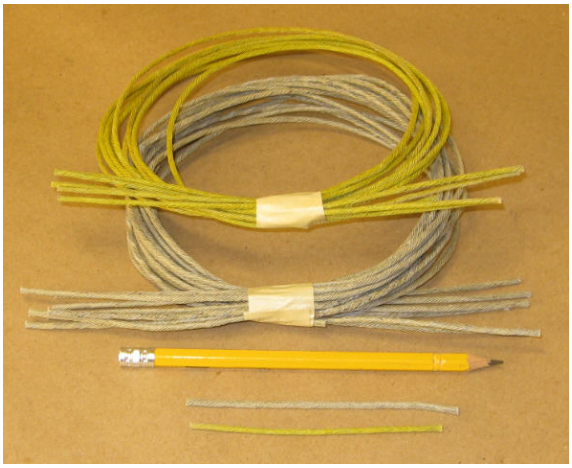


FAST BURNING Chinese Visco ignition fuse, yellow, 3/32-inch diameter. Burns at about ¼ second per inch (4 inches per second). Colored yellow so you do not use it in place of other, slower burning fuses. Skylighter #GN1100. Quantity needed—25 feet



Super-Fast Paper Fuse. Three thin strands of blackmatch, wrapped in tissue paper, 1/8-inch diameter paper fuse (1/16-inch diameter blackmatch strands). Paper-wrapped fuse burns at about 1 second per foot. Skylighter #GN1205. Quantity needed—10 feet of paper-wrapped fuse (yields 30 feet of thin blackmatch)

Flying Fish Fuse—Various Colors and Effects with varying diameters and burns at about 1.75-2.0 seconds per inch. Skylighter #'s GN1020 – GN1047. Quantity needed is 16 feet.



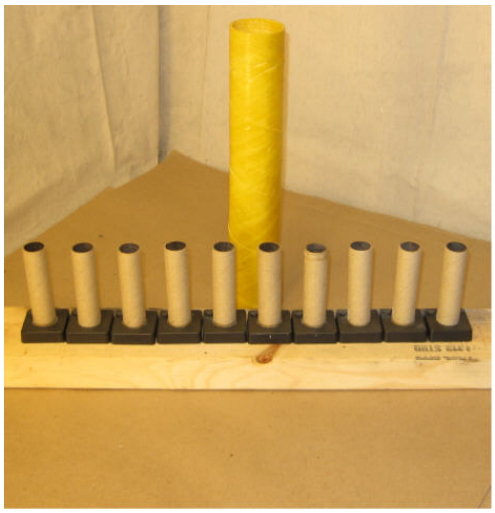
## Chemicals

- Potassium Nitrate (saltpeter), white crystals. Skylighter #CH5302. Quantity needed—2 pounds
- Charcoal, airfloat. Extremely fine, grayish-black powder. Skylighter #CH8068. Quantity needed—8 ounces
- Charcoal, 80 mesh. Skylighter #CH8066. Quantity needed—4 ounces
- Sulfur, yellow powder. Skylighter #CH8315. Quantity needed—6 ounces

- Dextrin, light yellow powder. Skylighter #CH8107. Quantity needed—2 ounces
- Clay, bentonite, very fine tan powder. Skylighter #CH8078. Quantity needed—1 pound
- FerroTitanium, -60+100 mesh. 40:60 iron to titanium ratio. Gray metal alloy powder. Skylighter #CH8113. Quantity needed—6 ounces

## Mortars

- Festival-Ball-Shell Mortar, 1 ¾ - 1 7/8-inch ID, fiberglass or HDPE plastic with plug. Various Skylighter product numbers. Quantity needed—1
- 3/4-Inch ID Mortars. A cardboard tube and a plastic base. Skylighter #TU2053 (tube) #PL3001 (base). Quantity needed—10 sets



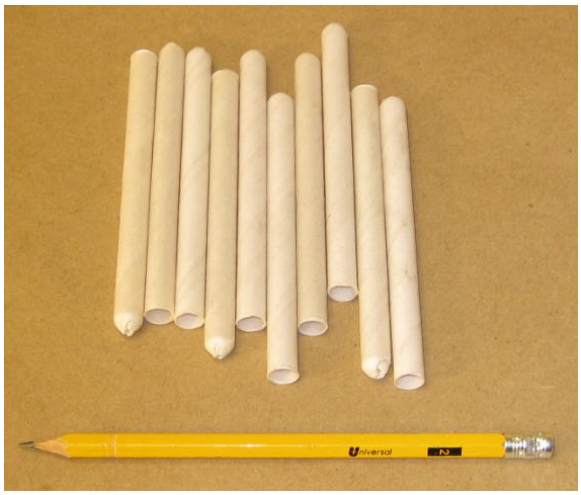
## Aerial Shell Casings

Plastic Shell Casing, 1 5/8-Inch OD, #5 Shell. Spherical, two halves, one with fuse hole for Visco fuse. Skylighter #PL2030. Quantity needed—5 sets

## Paper Tubes

Paper tubes, 3/8-Inch ID, 3.5-Inch Long. 1/8-inch wall thickness, parallel wound tubes. Skylighter #TU1008. Quantity needed—85

Paper tubes, 5/16-Inch ID, 4-Inch Long. 1/64-inch wall thickness, spiral wound lance tubes. Skylighter # TU2020. Quantity needed—15



## Tools

Combo-Tool set for 3/8-Inch Devices. Includes star pump sleeve, ramming base, 3 spindles, hollow ramming drift, solid drift, ram-through funnel, drill-guide, and drill bit. Skylighter #TL1402. Quantity needed—1 set


You can order everything in the list above from Skylighter.com.

Order the Turbo Supplies Kit containing everything.

Go here to check out the Turbo Supplies Kit. The cost is 20-25% of what the items above would cost if you purchased them all individually.

# Chapter 3: Everyday Supplies You'll Need for Turbo Pyro

## Goin' Shopping

One of the very real changes you will experience when you take up the art of fireworking is the new outlook you'll have when you go out shopping.

Walk into a grocery store, a department store like Wal-Mart, or a hardware store, and suddenly you'll see things with new eyes. "Hey, I could use that colander for screening chemicals," you'll think to yourself. Or those paper plates will have a new appeal.

You'll be looking at the world around you with new eyes, pondering creative ways to use products on the shelves, or trash in a dumpster.

The following is a list of the miscellaneous household items, which will be used in the Turbo Pyro projects.

You will already have many of these items in your home or out in your workshop. You'll come up with creative substitutes for some of these supplies, or alternative products, which will work just as well.

But, if you have something like each of these items on hand before you embark on the projects, you'll be prepared to get to work and stay creatively working without having to run out to the store to get something else.

These supplies are broken down into categories:

- Kitchenware
- Office/Shipping supplies
- Craft supplies
- Sporting Goods products
- Safety Gear
- Tools
- Hardware
- Miscellaneous household supplies
- Health and beauty supplies

- Miscellaneous supplies

Knowing which category a particular item is found in will help you identify which department of a store such as Wal-Mart in which to shop for the item.

The particular use of each item will be pointed out in each project in which it is used.

## Kitchenware

20-Mesh and 40-Mesh Colander Screens

These are colander kitchen strainers. On the left is a 40-mesh one, and the one on the right is 20-mesh. You'll need one of each mesh size.

## How can you tell what mesh they are?

Hold a tape measure against the wire screen. The distance between wires in a 20-mesh screen is just a little smaller than one of the 1/16-inch marks. There are 20 wires per inch, so the distance between wires is 1/20th of an inch, which is a bit smaller than 1/16-inch.

With the 40-mesh colander, the distance between wires is 1/40th of an inch since there are 40 wires per inch. That distance of 1/40th of an inch is just a bit smaller than one of the 1/32-inch marks on the tape measure. Buy one colander of each mesh size.

When you are purchasing your colanders, make sure to get relatively good quality ones. Make sure the screen does not push easily out of the framed rim because you will be pushing chemicals and mixtures through the screen.

## Blade-Type Coffee Mill


## Cookie Sheets


You'll need at least two cookie sheets, either permanent or disposable ones. Permanent ones are a good pyro investment since they get used in a lot of projects.

## A Set of Funnels


These flexible silicone funnels are ideal.

## Plastic Mixing/Storage Containers and Lids


It's a good idea to have at least 6 of these.

## A Set of Measuring Spoons


## A Bag of 12-Inch Bamboo Skewers

1/8th-inch diameter, or slightly larger, are ideal.

## Large Tri-Fold Display Board


Or some other source for pieces of corrugated cardboard at least 18-inches square.

## Office/Shipping Supplies

- Hot-glue gun and hot-glue
- 2-inch wide strapping tape “for heavy jobs”
- 1-inch wide masking tape (with optional dispenser)
- Elmer’s glue
- 2 tubes of super-glue
- Rubber bands
- Thin cotton string
- Thumbtack



- One package of thin tissue paper
- One roll of brown kraft paper
- A pencil
- A black Sharpie marker
- Optional Silver sharpie marker


## Craft Supplies

- Craft sticks (like Popsicle sticks)
- Assorted Wood Dowels (3/16-inch, 1/4-inch, 5/16-inch, 3/8-inch)
- Cloth sewing tape measure (optional, but pretty handy)


## Sporting Goods

- Goex FFg sporting-grade black powder (Graff and Sons online, www.grafs.com; or some BassPro shops)
- Hodgdon 777 black-powder substitute (optional)


Only the Goex real black powder will work in both the Flying-Fish-Fuse Mines, and in the Festival-Ball Aerial Shells. The 777 black-powder substitute can be used in the Mines project, but not in the aerial shells.

777 powder can be found in Wal-Mart gun departments and gun stores. Goex black powder is still available in some gun stores and sporting goods stores like Bass Pro Shops. It can also be ordered online, and it will be shipped HazMat and have to be signed for by an adult.

## Safety Gear

- Bucket of water
- Safety glasses (or face shield)
- Rubber gloves
- Dust masks (or higher quality respirator)


## Tools

- Hand-saw and miter-box
- Cordless drill and drill bits (1/16, 3/32, 1/8, 3/16-inch)
- Mallet (non-metal/non-marring head, rawhide mallet or plastic dead blow mallet are best, rubber mallet is OK for these small projects but not very functional for larger devices)



- Pump spray bottle
- Propane torch (optional, but handy for lighting fireworks)
- Tape measure
- Flashlight
- Razor-anvil cutter (Sears Handi-Cut or similar; often found in garden centers)
- 1-inch wide paint brush
- Sharp awl
- Single-edge razor blades
- Scissors

## Hardware

- Black spray paint (optional but nice)
- Duct tape
- PVC plumbing pipe cement
- 8-inch, thin, cable ties (2 packages of 20)
- 1- inch, 1.25-inch, or 1.5-inch drywall screws (10-20)
- #10 flat washers (2)
- 3/8-inch X 1.5-inch fender washers (2)
- 3-inch drywall screws (2)


## Miscellaneous Household Supplies

- 1 gallon of distilled water
- Paper towels
- Thin plastic sandwich baggies
- 7 to 8 ounce sized paper cups
- Round toothpicks
- Heavy, absorbent paper plates


## Health and Beauty Supplies

- Coarse-toothed comb
- Q-tips

## Miscellaneous Supplies

- Two 2-foot stakes, or one 2-foot stake and a fence post
- 8-foot piece of lumber to support wheel
- 6X6-inch X 30-inches ramming post (some folks cut a section of tree-log)
- Two, 5-6-inch bottom diameter, flat-bottom tubs
- Piece of scrap plywood, approximately 2X2-foot
- Two pieces of scrap 2X4 or 1X4 lumber

There you have it, your detailed shopping list. You can get creative and find some substitutions for these items. But never forget that there's nothing like having the right tool or material at the right time to make your projects go more smoothly.

Now, get shoppin'. You're gonna need all of this stuff for the following projects.

# Chapter 4: How to Make A Fireworks-Wheel Frame (Make 2 Wheel Frames)

## What Is a Wheel Frame?

To make a fireworks wheel, some sort of a frame, which rotates on a central axis, must be made. The pyrotechnic "drivers" which spin the wheel round-and-round, as well as any additional effects, are attached to the frame.

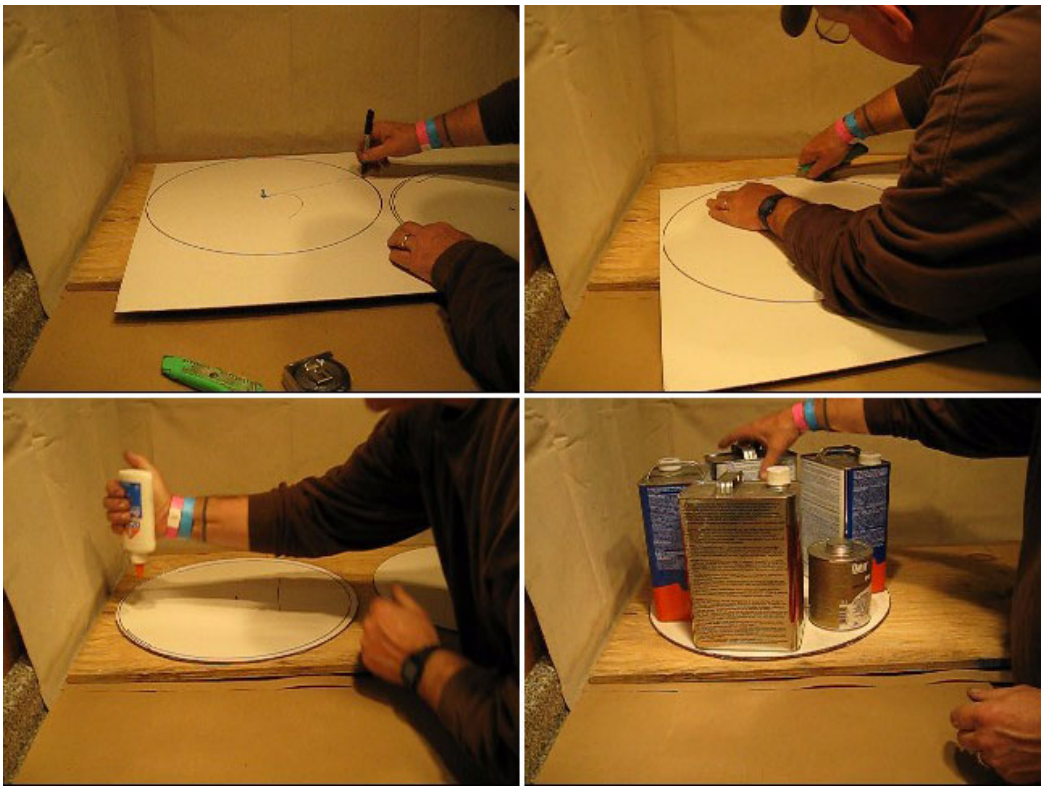
There are many ways to make frames for fireworks wheels. Corrugated cardboard frames are easy to make and widely available to anyone. But, even though they're quick, easy, and cheap to make, they won't last long, perhaps only for one use. (With a little more time and effort you can make wheel frames that will last a very long time. A couple of examples follow the cardboard frame.)

These discs can be cut out of pizza boxes (option: scrape the extra cheese off of them!) or any large, perfectly flat piece of corrugated box or other corrugated material. I made this one from a large school-project display board from Wal-Mart (about $4).


**Large Corrugated Tri-Fold Display Board from Wal-Mart**

Corrugated cardboard is better than non-corrugated. The reinforcing ribs inside the cardboard sandwich make it good and stiff. I cut two 18-inch diameter circles from the center section of my display board. You should glue yours together *with the corrugated ribs in each circle running at right angles to each other*. This will make a good, strong cardboard disc, about ¼-inch thick.

Weighted down overnight, your double-layer cardboard disc will be ready tomorrow for use as a wheel frame.



**Marking, Cutting, Gluing, and Drying Cardboard Discs**

**(click image to play video )**

Once it's dry, attach the cardboard wheel frame to a wooden support. You'll need a piece of any lumber at least 8-feet long, a 3-inch drywall screw, two #10 washers, two 3/8 x 1.5-inch fender washers, and a 1.75-inch long spacer tube (half of one of the 3/8-inch ID x 3.75-inch long paper tubes we'll be using in a later project). You can get all of the metal hardware at Wal-Mart or hardware stores.

**Installing Cardboard Wheel Frame on a Wood Support**

**(click image to play video )**

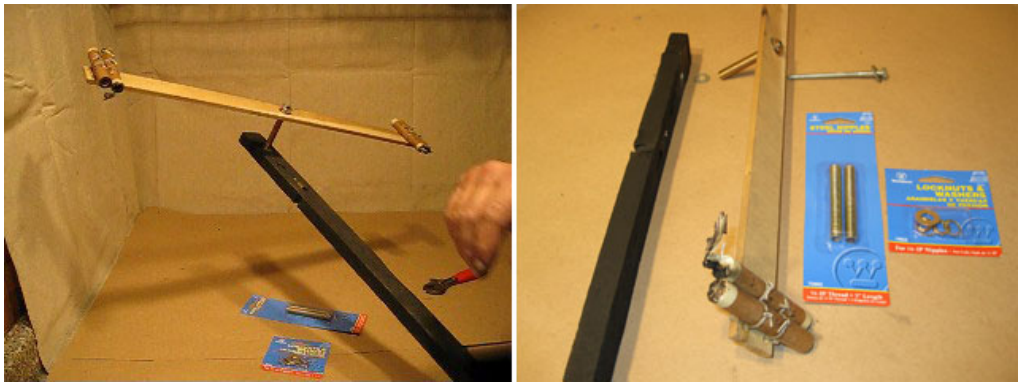
Any light colored parts will detract from the fireworks effects. So, spray-paint the cardboard and the wooden support black to keep them from being seen when the wheel display is running at night.

Note: It's easier to attach the fireworks drivers and auxiliary effects when the wheel is removed from the support. Then re-attach the wheel to the support before the wheel is to be displayed, after you erect the support or drive it into the ground.

## Optional: Longer Lasting Wheel Frames

Another traditional wheel frame is simply a piece of wood with a central hub installed. A bolt is inserted through the hub to attach the frame to a support. The hub is made from commonly available lamp parts from a hardware store.

Obviously, just because you are making a fireworks wheel doesn't mean the frame has to be round. This stick-frame disproves that idea. Nice frames can be made with more than one stick, using the same hub, crossed and attached to each other to create a frame.



**Wheel Frame Made from Wood Stick and Lamp Parts**

**(click image to play video )**

Another frame can be made using an old bicycle wheel. Local bike shops are always throwing out slightly bent ones.

Keep the original wheel bearings. Replace the axle with a threaded rod from the hardware store, just small enough to pass through the bearing hubs. Tighten the doubled sets of nuts and washers until they are just snug on the wheel bearings and the wheel can still turn freely.

Make sure the new axle is long enough to be installed through a wood support and held in place with more nuts and washers. If you want to get fancy and create a “counter-rotating” fireworks wheel display, make the axle long enough that another wheel can be installed on the other side of the support.

Drivers can be attached to the wheel by drilling some holes in it and using string, wire, or zip-ties to hold the drivers in place.

**Using an Old Bicycle Wheel As a Fireworks-Wheel Frame**

**(click image to play video )**

# Chapter 5: How To Make Flying-Fish-Fuse Mines (Make 10 Mines)

**Crackling-Silver, and Yellow Fish-Fuse Mines**

**(click image to play video )**

## What Is a Fish-Fuse Mine?

That's really two questions: What is a mine, and what is flying fish fuse?

A mine is a fireworks device, which fires a visual and/or audible effect that burns from the ground up. This is unlike an aerial shell, which is fired high into the air, and does its thing way up high.

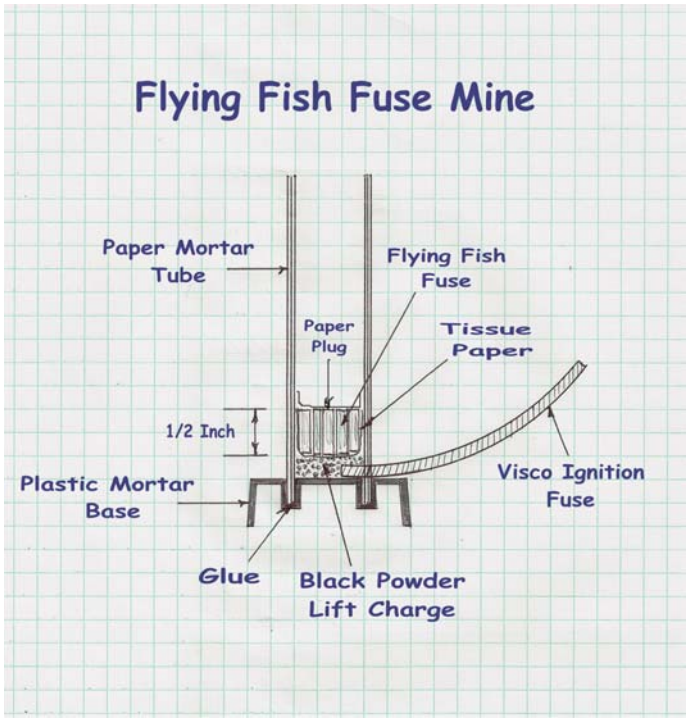
Flying fish fuse is a type of fuse, which, when cut in short lengths, appears to "swim" around in the air after it is ignited.

Mines can be large or small. The mines you make in this project are small, quiet, and suitable for use almost anywhere.

## Instructions for Making Flying-Fish Mines

### The Structure of a Mine

Here's a cross-section of one of the mines you are about to make.




**Flying-Fish Mine Cross Section**

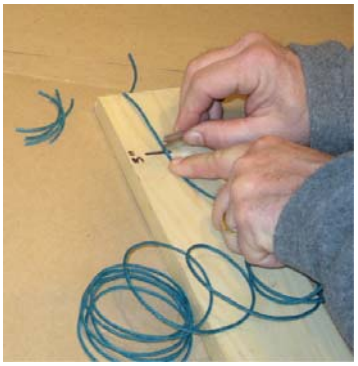
## Assembling the Mortar Tubes and Bases

Spread glue into the tube-recess hole in a plastic base. Push a paper tube all the way into the recess. The tube should stand up nice and straight when the base is flat on your workbench. Two of the little tubes of super glue are enough to glue all 10 mortars together. Super-Glue dries very quickly while the next assembly steps are being accomplished. If you use Elmer's glue, allow the assembled mortar to dry 4 hours or more before use.


**Gluing Mortar Tubes into Plastic Bases**

## Cutting the Visco Ignition Fuse into 3-Inch Lengths

It easiest if you make all 10 mines at one time. Cut off ten 3-inch pieces of green Visco ignition fuse (the 3/32-inch diameter stuff). Make a mark 3 inches in from the end of your "cutting board." Then, use a single-edge razor blade to cut the fuse into the ten 3-inch pieces.



**Cutting Visco Fuse into 3-Inch Lengths**

It's easier to use scissors, right? *Do not use scissors to cut the fuse.* It is much safer to use a razor blade or anvil cutters. Scissors have been known to accidentally ignite fuse.

Also, remove any black powder or fish fuse from your workbench while cutting the Visco fuse.

A good question to always have in the *front* of your mind is, "If what I'm working on catches fire, is there anything else the fire can spread to?"

If there is any flammable material around, seal it tightly in a container, such as a cooler, to prevent any accidental ignition. Assume that you WILL have an unpredictable, accidental ignition, and always operate that way. In fireworks making, forming this habit can be the difference between life and death.

## Cutting the Flying-Fish Fuse into 4-inch Lengths

The flying-fish fuse is packaged either as 39-inch (one meter) lengths, or rolls of 100 feet. You will need to cut these into little, ½-inch long pieces to use in the mines.

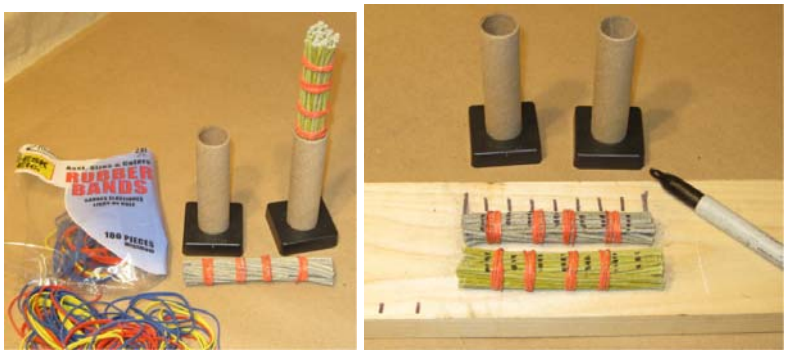
Working with pieces of fuse that small can be a pain. Here's the easy way to do it.

First, mark the cutting board every 4 inches with your Sharpie. Then, use your razor blade or anvil cutters to cut enough 4-inch lengths of the fuse to snugly fill

one of the paper mortar tubes. This bunch of fuse can be all one color, or any combination of colors.

**Cutting Fish Fuse into 4-Inch Lengths, Bundling the Pieces in a Mortar**

Use string or rubber bands to tie the bundles of fuse every ¾-inch. With the bundle all the way in the mortar, put a tie around the bundle right above the top of the mortar.



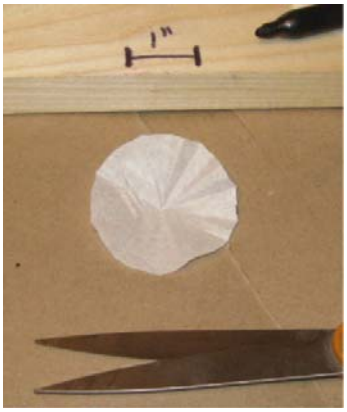

**Bundling and Marking Bunches of Flying Fish Fuse**

Then pull the bundle out about ¾-inch, and put on another tie. Repeat this two more times. Then remove the bundle from the mortar tube.

On the cutting board, divide the space between two of the 4-inch marks into ½-inch spaces using your Sharpie. Then line each bundle of fuse up on this section. Use your Sharpie to make ½-inch marks on the bundles. This is where they'll eventually be cut into individual "loads" for the mines.

## Cutting 2-Inch Diameter Tissue-Paper Disks

One final preparatory step is necessary before a mine is actually loaded for firing. Cut some 2-inch diameter tissue-paper disks.




**2-Inch Tissue Paper Disk**

## Assembling a Flying-Fish-Fuse Mine

Now all the materials have been prepared, and the tools are ready. It takes about a minute-and-a-half to actually load a single mine.


**Ready to Load Flying-Fish-Fuse Mines**

Use a pick or an awl to make a Visco fuse hole in the paper mortar tube right at the top of the plastic base. Insert one of the 3-inch pieces of Visco fuse into this hole. It should be small enough to hold the fuse securely in place.

**Piercing Hole in Paper Mortar Tube, Inserting Visco Fuse**

Now load the black powder lift charge. The lift charge will propel the pieces of fish fuse into the air once the Visco fuse burns in to the point where the powder is ignited.

Use three level ¼-teaspoons (3.5 grams) of Hodgdon 777 black-powder substitute. Or use a level ¼-teaspoon (1.5 grams) of Goex FFg black powder.

**Warning: The black powder used in this step is the most powerful component of this device. When you finish loading a mine, put the excess powder back in its original container, and put that container in a day box or other safe, sealed storage. Keep the work area clear of all flammables that are not actually being used. Minimizing exposure to unused explosive materials is absolutely the best way to reduce the risk and consequences of a serious accident.**


**Loading Black Powder Lift Charge in a Mine**

To load the flying fish fuse into the mortar, wrap one end of a fuse bundle with the disk of tissue paper. Then carefully insert that end of the bundle into the mortar up to the first Sharpie mark on the bundle.

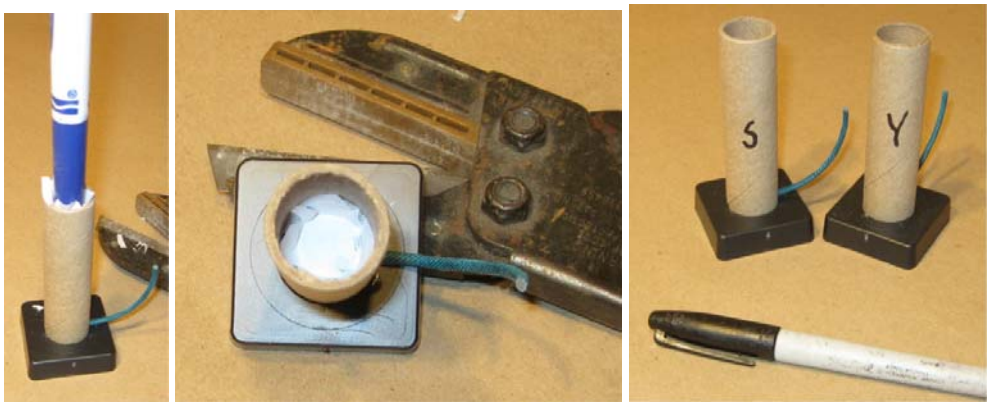
Using the anvil cutter carefully cut the bundle at that point.

Then push the tissue-wrapped fuse bundle all the way to the bottom of the mortar. A magic-marker or a 5/8-inch wooden dowel both work well.

To load another mortar tube using this same long bundle of fuse, simply remove one of the rubber-band ties, and repeat the process.

**Inserting Tissue-Wrapped Bundle of Fuse into Mortar, Cutting ½-Inch Length of Fuse Off, and Pushing Fuse-Bundle to Bottom of Mortar**

To finish the mine, one of the little1.5-inch-square pieces of paper is placed over the end of the paper tube and pushed evenly down to the top of the fish-fuse bundle to secure it in place. The paper will keep the fuse from falling out of your mine, and protect it from stray sparks from other fireworks.




**Pushing 1.5-Inch Paper Square Down on Top of Fish Fuse, Marking Mines for Future Identification**

Mark the mine with the effect it contains so you can identify it in the future.

And that's it: flying-fish-fuse mines. Light carefully and retire. Store all finished devices and pyrotechnic materials in a safe location.

# How to Make a 10 Shot Flying-Fish Mine Barrage

## What Is a Flying-Fish Fuse Mine Barrage?

**10 Shot Flying-Fish-Fuse Mine Barrage**

Traditional fireworks mines propel burning stars from the ground up into the air, and look something like this:

**A Barrage of Mines Made from Colored Stars**

With this project, you can make your own version of the same thing, using flying fish fuse. Not only will the pieces of fuse be propelled skyward, producing their unique effects, but they will also zip around like swarming bees.

The whole project should take you no more than an hour to assemble. It makes a beautiful fireworks display.

And after you tackle barrages made with flying fish mines, you can reuse the same mortars and reload them with different flying fish fuse or small stars.

Flying fish fuse is available in a wide variety of colors and effects. So when you've used up the kind you originally got, you can order more and experiment with the different types.

All of these materials will be assembled into a bank of mines.

If you are working with "young assistants," you may want to let them decorate the paper mortar tubes before they are glued into the bases, and before any flammable materials are present. Kids' washable markers can be used to create cool designs, or a 3.25-inch by 3.25-inch piece of gift-wrapping paper can be glued on the tube to decorate it.


**Decorating Paper Mortar Tubes**

You'll notice that the 3.25-inch-wide decorative-paper wrapping leaves ¼-inch of the tube exposed. This end will be glued securely into a plastic base.

## Making the Mine Barrage

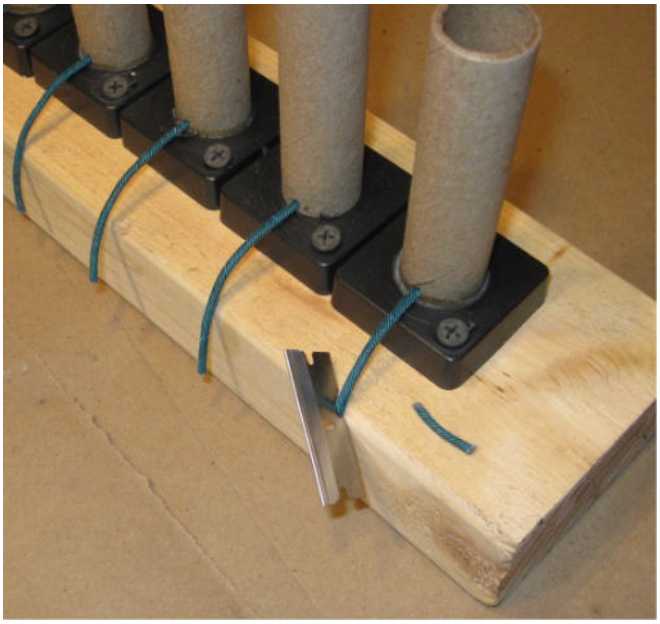
You know how it is: if one mine is good, 10 have got to be so much better.

So, here's what to do. Join a line of mines on a board, all linked together with one fuse, so that they fire one after another right down the line, sort of like a multi-tube repeating firework device.

First, drill a hole in one corner of each plastic mortar base, and screw the mortars to a scrap piece of 2x4 board. Pierce the bottom of each paper tube, and insert a piece of Visco fuse into each mortar.

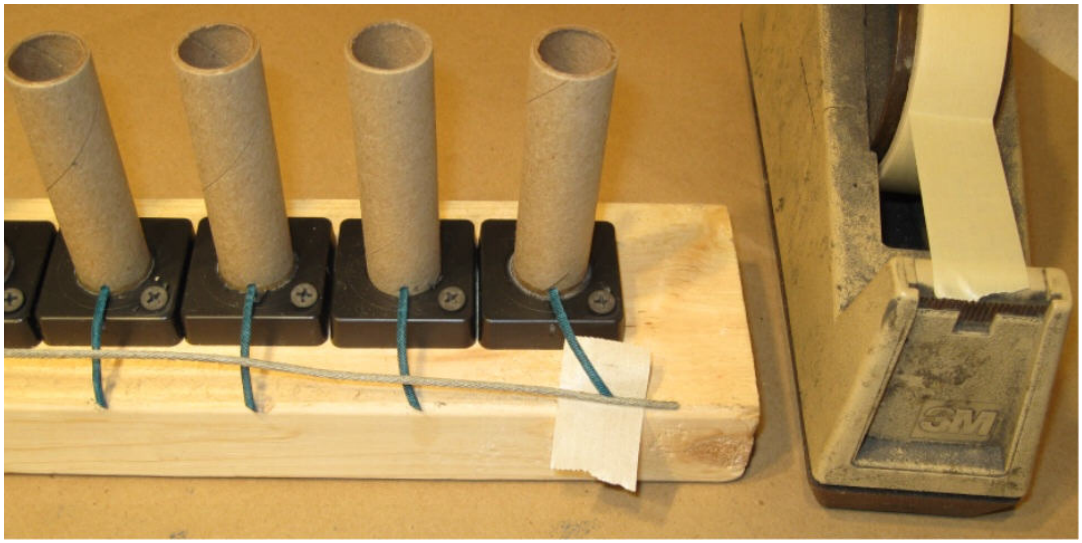
**Attaching Mortars to 2x4 Board**

Next, slice each piece of Visco fuse with a razor blade. Make sure each fuse is the same length, and cut the end on an angle to expose as much fuse powder as possible for good ignition.

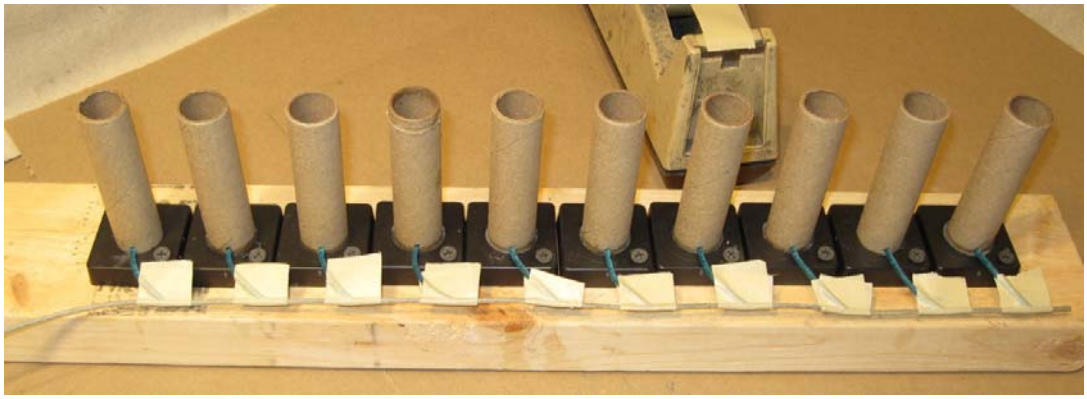


**Cutting Visco Fuses on Angle to Same Length**

Use masking tape to tie the angled-cut end of each Visco fuse to a length of the flying-fish fuse, or yellow fast Visco fuse, being used as a “barrage chain fuse.”




**Tape End of Visco So It Touches Barrage Chain Fuse**



**Masking Taped & Fused Flying Fish Mortars**

Load each mortar with the black powder lift charge, ½-inch fish fuse bundles, and paper plug as you did with the single mines. Try alternating the different colored/effects fish fuse loads.

**10-Shot Fish Fuse Mine Cake, Loaded and Ready to Light**

**10-Shot Flying Fish Fuse Mine Barrage**

**(Click Image to Play Video )**