
October 2012, Vol 23-2
Western Pyrotechnic Association
Newsletter

FLYING PHOENIX FIREWORKS

P.O. Box 31
Riverton, WY 82501
307-856-0778
flyingphoenix@tcinc.net

COWBOY BRAND

#92 CiHair Lane
Arapahoe, WY 82510
307-856-3336 FAX
Mon.-Thurs 7am -5:30pm

Exclusive Items

1.3G

300sh Red/Green/Blue Moving Star
100sh Coconut Pistil w/Red Tadpole
100sh Blue Tail to Brocade Crown Crossette
110sh Fan shaped - Silver/crackling/blue/ red/green glitter mines to blue tail to chrys willow
100sh Fan shaped - Three stage massive crackling mine
88sh Fan shaped - Flying Gold Eagle
80sh Fan shaped - Ice on the Cake (brocade crown w/blue and crackling mine)
48sh Fan shaped - Silver Waterfall
48sh Fan shaped - White Strobe Waterfall
300sh IZI shaped - Colorful Whistling
5I - 10I Red, Silver or Blue Ghost Shells

1.4G

Cowboy Brand
Midnight Cowboy
Cowboy Copperheads
Night Rider
Eureka!
Mountain Meadows
All the Stars in the Sky
Lightning Crackers
Nite Lights Artillery
Jumbo Gold Crackers
Cowboy Couple
The Outlaw
Sky Plazma Artillery
The Mother Lode
Weeping Willow
Gone Fishin'
Cowboy Up!

More Brands in Stock

Brothers	Lightning Bolt	Beihei
Shogun	Black Cat	Wizard
Winda	Flower King	Hulsky
Cannon	Flying Dragon	Lidu
Golden Bear	HopKee	Yung Feng

To receive a catalog or request information, please call or email. Ask for Jim or Becky on 1.4G and or Glen for 1.3G.

WPA Newsletter, Volume 23, Issue 2

Table of Contents

Corporate members	4
Editor's Remarks	5
Do It Special Report	6
Firework Factories of India	18
Ice Fountains	34
Business Section	37



Do It was way too much fun …

Elected Officers of the WPA

President: Lynden king.
VP: Greg Dandurand
VP publications: Pete Hand
Treasurer: Ann Hill
Secretary: Kathy Bauer

Cover Picture: "Fistful of Rockets" by Mike Garrett

IMPORTANT NOTICE

The Western Pyrotechnic Association, Inc., also known as the WPA, is a non-profit group of fireworks professionals and their apprentices. This newsletter is a vehicle for their exchange of information in this craft and the right to publish this information is guaranteed by the Constitution of the United States of America. Nonetheless, readers are urged to learn and obey all laws and regulations of all federal, state, and local jurisdictions and of their agencies and representatives. Some information herein may contain incomplete descriptions of fireworks techniques based on the experience of its author(s) in a controlled environment with circumstances, and conditions different from the reader. Readers must form their own opinion as to the application of this information. This information is considered documentary in nature and no opinion is given as to its suitability or use. No warranties are made either expressed or implied, including but not limited to warranties of the accuracy of the information herein. The WPA is not responsible for the opinions of authors or mistakes in printing. All information is intended solely for viewing by members of the Western Pyrotechnic Association, Inc. and its associates. The WPA's entire liability and anyone else's remedy shall be a refund of the subscription price. In no event shall the WPA, or its officers, or the editor, be held liable for any damages whatsoever arising out of use or inability to use the information in this publication, even if said parties have been advised of the possibility of such damages. This publication is published by and is the sole property of the copyright owner, and is not to be sold or reproduced in whole or in part without written consent of the editor and publisher. The contents of this newsletter are Copyright 2012. All Rights Reserved by the Western Pyrotechnic Association, Inc., or the author(s), if so indicated, and is re-published by permission of the copyright owner. Any previous agreement to allow any one to re-publish any material from the WPA, Inc. Newsletter is revoked and void as of March 1, 1995. Reproduction without permission will be deemed a purchase and implied authorization by the user to accept billing and make payment of a minimum $50 user's fee per instance of use. Distribution is limited to paid subscribers. Submission of written material, graphics, and photographs dealing with pyrotechnics or fireworks, related technologies or activities of, and information to the benefit of the members of the WPA, Inc. are gladly solicited. All submissions become the property of the Western Pyrotechnic Association, Inc., and may be edited or rejected for any reason. No payment is made for submissions and submitted materials cannot be returned.

WPA CORPORATE MEMBERS

Combined Specialities

Novato, CA

Extreme Pyro

Mansfield, TX

Flying Phoenix

Riverton, WY

Holatron Systems LLC

Honolulu, HI

Pyro Novelties

Lenexa, KS

Pyro Spectaculars

Rialto, CA

Friends of the Fair

Lake Havasu City, AZ

We would like to take this space to express our thanks to our corporate members. These are folks who recognize that the health and longevity of pyrotechnic clubs and organizations is responsible in part of the continued success of fireworks in America. In these economic times, their support can be especially hard on them. It goes above and beyond the standard.

The WPA relies on our corporate members' continued support for the health of our club.

Do us ALL a favor and be sure to use their services.



Photo credits this issue:

Mark Devon, Dave Ferguson, Mike Garrett, Pete Hand, Gina Papini, C C Pepperworth, Lonny Ross, one other person unknown.

Editor's Remarks

Well, I asked for it, and you didn't disappoint. I had so much material sent to me after Do It that I scarcely knew where to start. Everyone had such a good time at Do It this year - if you didn't go, you really missed out.

Do It is, of course, a "maker" event. Professional goods are available from Flying Phoenix, but the emphasis is very much on do-it-yourself. Perhaps that put you off - maybe you didn't come because you're not a maker, or you're slightly intimidated by the more experienced makers with their huge shells and mighty rockets. Don't let that worry you. Quite a few people at Do It this year were making their own for the first time, and some of them have shared their experiences below. We don't have classes and seminars at Do It, but we do have the most friendly and helpful people who would be only too glad to share their knowledge and show you the ropes.

If you want to be a maker, but you really don't know where to start, I'm planning a series of short starter articles on how to make stars, powder, shells and rockets. We have in the WPA two of the great celebrities of the pyrotechnic world - Robert Winokur, who (literally) wrote the book on glitters, and Robert Veline, whose Veline Color System was the first step for many of us on the path to color stars. We are a maker club - let's keep up the tradition.

Also in this issue we have part two of Peter Schoewe's article on the Firework Factories of India.

Thank you to everyone who contributed and made this newsletter possible. I used as much as I could fit in.

Pete Hand



POSTCARD COLLECTABLES*

Postcards with a firework or other especially patriotic illustration appeared about the time of the first picture postcards. The type of large firecrackers depicted in the example shown below are described as *cannon crackers, which* were in common use at the time.



Unless the postcard has been mailed and carries a postmark (i.e., date), it is generally not possible to establish a reliable date for its production. Note that the post mark on the above postcard is July 3, 1907. Another example of a firework collectable postcard is shown below.



* Abstracted with permission from the ***Encyclopedic Dictionary of Pyrotechnics***. For information about this publication contact Bonnie@JPyro.com.

DO-IT REPORT

Well DO IT is over now. I hope all that attended this years DO IT had an enjoyable event. I'm already looking to get the planning process started for next years DO IT event.

I would like to thank everyone that showed up and supported this years event. For those of you that couldn't make it, you were missed, talked about, and probably made fun of... Kidding aside, I hope you are able to come check out DO IT at the new location in Hawthorne next year if you haven't already.

This year was our biggest turn out with attendance at DO IT since it has been in Hawthorne, NV. Total registered for this even was in the low 130's.

I would like to send a Big Thanks to all the staff that helped pull this event together. DJ, Kathy B, Ann H, Richard H, Greg D, McGregor, Ken K, Steve H, Bill R, Lenny, Tom C, John "Stinkbug", Maureen D, Gina and many more... Sorry if I left someone out.

I also would like to say thanks to Flying Phoenix for providing Class B & C product and Bear River Powders for providing Black Powder. Thank You for your continual support of the Club.

Joe Wright
DO IT 2012 Chairman



DO IT manufacturing area

WPA DO IT 2012 - Dave Ferguson

When I first arrived at DOIT 2012, my plan was to observe the builders, and learn something new. I live in Hawthorne, so I had the option to change the plans easily if the situation logically dictated. I joined WPA in December, and went to Winter Blast. I was motivated there to get into manufacturing. When I came home in February, I ordered a set of stinger rocket tools. My lifetime motto is Live Life To The Fullest, Otherwise Why Bother? I have been accused of taking that motto too serious at times.



I ordered a set of six pound tools, a tumbler, chemicals to make about 16 pounds of black powder, six pound tubes, 5 pounds of bentonite, I had cannon fuse already for my six pound civil war cannon, and I had quite a few pounds of cannon powder in the garage. The ball mill showed up first, followed by the black powder kits. Next the six pound tubes, and bentonite. When I looked at the six pound tubes I thought what have I done, what was I thinking??! I read up on making black powder, it sounded pretty simple and straight forward. I had 500 hard cast .45 Colt bullets in the garage, so I decided to use that for media. I scraped the wax out of the lube rings in the bullets, put 75/15/10 mixture into the small tumbler along with the bullets, ran it for about 1.5 hours out in the country at my nephew's house.

Can you see the mistakes of a newbie accumulating here? First Jump into things with so much enthusiasm, Logic is suppressed and excitement takes over. I had read the documents, but still did not know enough. I decided the first rocket should not have a header, because I was not sure what it would do. We put the rocket out on the asphalt street on a cut off nail in a two by four. I told my nephew to light it and run, we were not sure what it might do. As it worked out running was a good idea! The rocket spun on the nail for way too long, and lazily headed up till it got 15 or maybe even 18 feet above the street, and headed down the street above the asphalt. Luckily there were no cars coming down the street. Then it came back down, and bounced along the street like a race car with no tires. Sparks flew as it made it to the far side of the neighbor's property. Lesson one: use clean media! Lesson two: mill your bp at least three to four hours. The bullets still had wax on them, so it polluted the B.P. mix so it was not hot enough. Also there was not enough lead in the tumbler to properly make the B.P.

Now, I decided maybe, just maybe I should have started with a smaller size rocket. I ordered a one pound stinger set, and waited, … the one pound stinger worked fairly well with the weakened bp mix. I made several one pounders, and decided to go back to the six pounders. I bought a larger tumbler so I could make three pounds of B.P. at a time. I did get the six pounders to work pretty well finally. I now let my B.P. run for five hours (with clean media).

I ordered a star press, a star pump a cutting screen, parlon, copper carbonate, lactose, magnalium, potassium perchlorate, red gum, and other star making chems …Now rubber stars 010: (I would use rubber stars 101, but it was a disas-

ter!) I used nitrile gloves just like the instructions recommended. The gloves dissolved while mixing the parlon and acetone, etc. What a mess! The star mix had large pieces of gloves mixed in it, and my hands were covered with horrible sticky pyro goo! The blue stars that I was able to prime were awesome! I also made some non rubber stars. I have a lot of chems in my office. I think the WPA has tainted my blood just a tad!

Now back to DO IT 2012. I walked around the construction area after attending the safety lecture. There was a great bunch of people building stuff, just like winter blast. I talked to some of them, and stopped at Al , and Andre's setup. It was then I decided to go home and get some of my stuff, and join their projects. I had manufactured a special launch pad that allowed five stingers to be launched at the same time, but never used it to launch more than one at a time. I had some extreme fast visco, and made up a harness with five fast visco fuses with equal length connected to some standard visco. This worked very well!

A couple of people came by asking questions about stingers, etc. I coached them through their first stinger missile, or their first six pound stinger missile using my tools. One guy used his chems, another guy used my chems. Craig Nixon, a new WPA member also joined in and made quite a few rockets with us. I think Craig is at least partially hooked now.

Then I saw Bruce's rockets!!! WOW now that is the direction I wanted to go! I asked Al, and Andre if they had ever thought about making their own rocket motors? I can't remember the exact answer, but shortly we were talking about motor building. When I returned home, I ordered a set of six pound full size rocket motor tools, a bunch of 32 inch long, six pound tubes, 12 pounds of 80 mesh charcoal. I have been on the phone with Rich and Claudia Wolter, I will make some 60" ¾ X ¾ rocket sticks. I have the back side of Walker Lake to use as my test ground. Soon I will be testing. Mr. John Dicks if you see a glow in the eastern sky followed by a flash, my test launch happened, hopefully it was a success!



What fun to go to Do-It this year. It was hot and the wind blew, but everyone I talked to was having fun. The folks in the manufacturing tents were busy but didn't mind taking a break to talk. There were new toys to watch and new inventions, built for enjoyment or for the good of pyrotechnics. Three days goes by why to fast, Hawthorne is such a great place for Do-It. See you all next year. - C C Pepperworth



Just wanted to write a quick note to let everyone know how much fun we had at “Do-It” and what it was like to bring a new person into the pyro family. Our friend Dave Scurti came with us and is now completely addicted to pyro and manufacturing.



It started with the setting up of tents and then.... the box of rockets came out. Has anyone ever read the warning label on those rockets?



Good thing we are all “professionals”. All of a sudden the eyes lit up and the wheels in the mind started turning. What could be attached to rockets besides a stick? I now know why my Dr Pepper cans turn into plastic bottles right before “Do-It”. My husband Victor figured out that the bottles fit perfectly on top of these rockets and can be filled with anything.Quick match, stars, strobes, gasoline, smoke canisters.... then to wait for dark. Usually it was back to the drawing board to try again the next day. We always get a laugh out on the “B” rocket line. I now know why the rocket line is so far removed from everyone else, one of our rockets decided to take a road trip after it bounced out of the gun. The only video I got of that test rocket was the dirt. I was laughing so hard, I couldn’t hold the camera up straight. Everyone got a good laugh out of that test and Victor got a new name- Wile e Coyote.



We also met another “newbie”, Andrew. We called him our intern. Poor Andrew, had to work for shells. He’s hooked.

Gina Papini



BIG GUNS



Maureen fires Craig's 1.5 inch caliber Naval flintlock at Do It

Bruce's 3 inch caliber acetylene cannons in the background





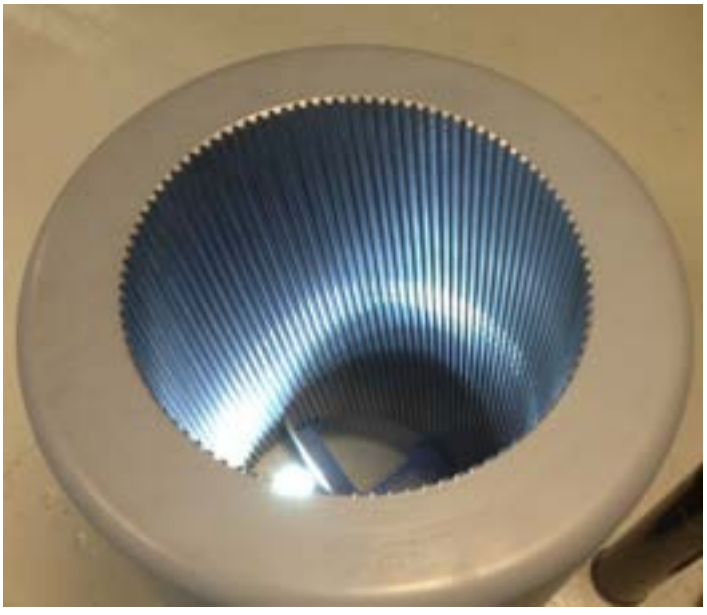
AK47s for fun and recreation



Jackalope Gattling Gun, for firing consumer shells



Below: A section of a real 16 inch gun barrel, seen in the museum at Hawthorne.



This was my first year with the WPA and my first pyro event. I can honestly say it was the best weekend of pyro I have had in my life thus far. I saw so many things I could not see anywhere else, met a fantastic group of people and made plenty of new friends. The club has a great mix of members and I was so happy to be welcomed into such an organization of free flowing information. When registering for the event I had no intention of manufacturing my first year and ordered a bit to much product but managed to get it all up, and with the great members help also managed to build and shoot my first shell ever (6") and my first 3" mine. I am now hooked and will be attending Do-it 2013. - Lonny



El Presidente



Another big gun



Gina and her smoke rocket



Dave Peters' insert factory



Loading a large shell at the electric line. Shells over 6 inches are fired remotely for safety reasons.



Helga puts a rocket tube in a sleeve, ready to press







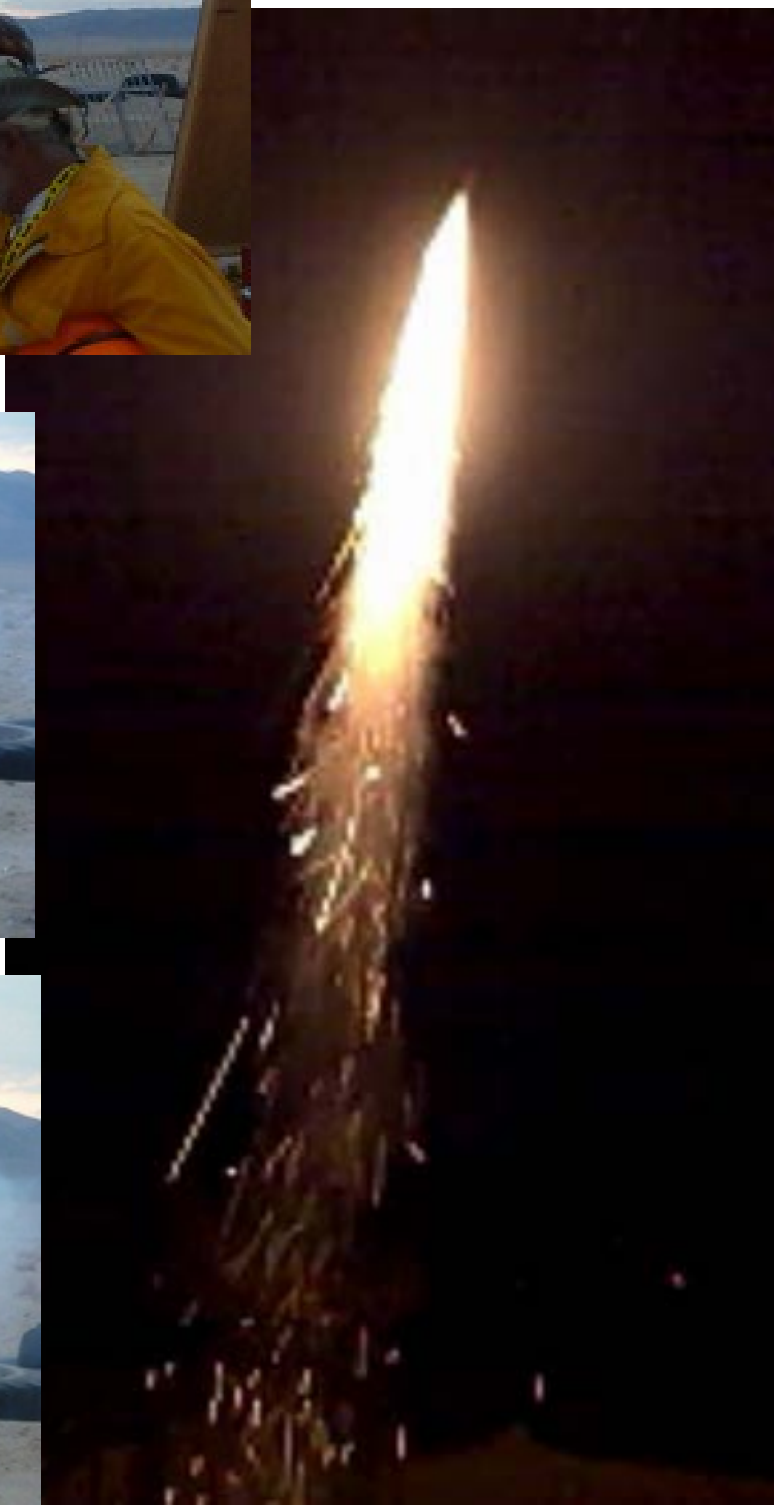





B Rocket Line - where the cool guys hang out



It's the first place to go if you're looking for Bill







Armageddon Set Piece



This set piece is typical of the fixed displays that used to be popular fifty or sixty years ago. A lot of work went into this item, which was quite spectacular. It began with a wheel, then burst into a tree of brilliant titanium fountains.

Congratulations to the makers!

Unfortunately the photos don't do it justice - the brilliance of the wheel washes out the colors, and smoke obscures the fountains.

You just had to be there, sorry.



A Do-It article wouldn't be complete without a mention of the AFTERGLOW…

Unfortunately, nobody took any PICTURES, so you'll have to use your imagination. In the picture, Maureen is showing everyone how big the portions will be at supper later. I know this because I was there (arrow). Now imagine the same scene, but pitch dark, and we're all holding plates of delicious food and bottles of the finest designer beer.

Let's hear it for the Afterglow caterers - Best in the West.



The Firework Factories of India

By Peter Schoewe

This four part article covers 12+ firework and Chemical factories of Sivakasi India.

Part Two of Four

The Sri Kaliswari Aluminum Atomizing plant

The Kali Cock Brand Match Factory

The Sri Krishna Chemical Plant

"The government of India has so many laws regulating firework making that the laws have become counter productive." A factory owner said.

My cell phone wouldn't work in Sivakasi only in Mumbai and Delhi did I get a reception. Then it was hard to get my hotel phone to work. Half the time there would be a dead signal. Other times, instead of reaching a factory manager at his office I got the wrong number of someone's house. When they answered, I was amazed to find them speaking English without missing a beat. Even though I may have been the only foreigner wrong number they ever received.

Sivakasi is famous for fireworks, stick matches and printing. They sell a lot of stick matches to Africa, South America, and elsewhere. The fireworks are mostly for their domestic market.

The fireworks factories in India are not as big as China's. India exports no more then five percent of what they make compared to China which exports around ninety-five percent. One reason is that India's fireworks are more expensive, even though the labor is cheaper. In China, employers pay $6-10 a day for their workers while in India it's only $2-5 a day. In India they start around 8:30am and finish by 5pm, six days a week. Working over time in firework factories is against the law.

Another reason is that there's a thirty percent import tariff on raw ingredients such as chemicals, I've read on line. However, because exports aren't as high this gives their economy an advantage of being more independent. The country has had the ability to remain strong while the rest of the world struggled. This is changing too. A few years ago we could get forty-two (42) Rupees to the dollar. As of February of 2012 it's Fifty-five (55) Rupees to the dollar. The India's economy shrank by nine percent during the year 2011 according to the BBC.

It was common to see barbed wired fences surrounded factories if not tall cement walls. The posts for the barbed wire were always made out of stone, since good building wood is scarce.

All firework products weren't made at the same time. Many factories would concentrate on making a number of products for periods of several weeks to a month. Then switch to make other products. Only at the largest factories could they make all of their products year round.



The Rotary and Lions clubs are popular with business and factory owners.

Bamboo shacks along side the road served coconut juice. A man would cut the top off of a coconut with a machete and put in a straw to drink from. Afterwards there was soft coconut meat inside to eat with a spoon. Drinking coconut juice out of coconuts is popular in Asian countries. Did you want an unripened or really unripened coconut drink? Eating meals on the other hand was done with our fingers only. No forks, knives or chopsticks, however spoons were used for soup.

Office workers worked until 9pm, with two hours for lunch from two to four pm. They didn't take calls during their lunch break.

The Sri Kaliswari Aluminum Atomizing Plant

On Friday at 9am I was picked up by a representative of Sri Kaliswari Aluminum, Mr. Padbanaman and a driver. We drove twenty minutes north in a late model car with heavy tinted windows. Sri Kaliswari is the largest fireworks company in India and they own their own aluminum atomizing plant. Standard Fireworks is the second largest. Sri Kaliswari is newer, they started in 1923 and now have around twenty factories in all, with over 7,000 employees.

The tall heavy steel doors of the gate were opened for us to drive in to the atomizing plant. The plant property looked to be ten hectares (twenty-five acres. There are 2.47acres to a hectare) It was clean and well kept. There were nine owners in all. In the office one salesman put out some cookies.

Mr. Padbanaman, one of the nine owners, handed me a chemical analysis report showing purity, screening requirements, and four different types of quality testing done multiple times with each batch. There were figures that went on for ten pages.



FACTORY OFFICE

There were five aluminum atomizing plants in India. They received most of their aluminum from a mine in the North eastern part of India.

The price of the finished powered Al. was anywhere from $4.20 US to $7.50 per kilo. (There are a little over 2.2 pounds to a kilo.) The shipping containers they used for chemicals were twenty feet long and could hold up to eighteen metric tons of weight without pallets. But if pallets were needed they would take up space, and then the shipping container could hold up to nine metric tons. (There are 2,204.6 pounds to a metric ton.) All items in the container must have the same shipping class. This means fuels must go with fuels and not mixed with oxidizers. They've sold aluminum to Canada and a lot to Germany, for the painting industry, as well as to the Middle East for making cinder blocks. Without aluminum the cinder blocks wouldn't be as strong.

This factory has been there for nine years. During this time, they've given about one tour a year and they told me I was the first American

The smallest particle size they screen is through 325 mesh. No eight microns or anything close to that. It's very hard to get a license to produce anything smaller than 325 mesh. If you do have such a license, then whatever you make can only be sold to the government or for export. On the other hand if your final screening is -325 mesh, then there are no license requirements at all. You just make sure your factory is far enough away from any neighbors and twice a year a federal inspector will check air quality for dust in the work areas.

Four of us left the office to have a walk around the plant: two sales people, one of the owners and myself. All three guides spoke good English.

When the Aluminum arrives from the smelters it goes to the lab. The aluminum usually comes in twenty kilo ingots by the train car load. The Al. is tested for purity. They've found, copper, zinc, magnesium and nickel in small trace amounts. When they find too many impurities they will complain to the smelter and that Aluminum will get used for paint pigment. Most of it is pure enough to be used for anything they make. They atomize over 2,000 MT (metric tones) of Aluminum per year. 1,200 MT is for fireworks. That's up to eighty, twenty foot long shipping containers a year!

In the lab there was a print-out from a computer that showed the results they tested from one batch of Al. just received from a smelter.



THE CACHE TEST, (BURN SPEED OF ALUMINUM)

After the aluminum has been atomized, samples of it come back to the lab for more quality checks. A lab worker demonstrated by putting a lit match to a small cone shaped pile of powdered aluminum. Then a digital stop watch was started. The aluminum pile turned red at the tip and slowly burned it's way down to the bottom getting brighter then burnt its way back up to the top. Depending on how fast it burned this would tell the lab worker how successful each batch was. Different grades would burn at different speeds. The lab tech demonstrated how one pile didn't burn at all. If that batch was meant for fireworks it would have been rejected.

From there we walked to the atomizing room. The atomizing is done in batches. Each batch is between 150-250 MT. (A metric ton is 1,000 kilos.) A fork lift raises up a pallet containing four, fifty-five gallon drums filled with twenty kilos bars as well as scrap aluminum. A man standing on the pallet dumps the bars in by hand into a large melting hopper. In all it takes 30-40 days to process the 150-250MT of aluminum until its finished powder.



ONE OF SEVEN BALL MILL BUILDINGS



HOPPER FOR MELTING ALUMINUM

Two and a half metric tones go into the furnace at once. They heat it up until it is melted. From here a stream of melted Al. goes through a hole at the bottom of the melting hopper. Air is injected and the Al. shoots out parallel to the ground into a large holding hopper that is seven meters long with walls 2m high. Within a short distance the fine spray of aluminum powder floats down and through a grate at the bottom. The furnace was not running this day since the plant was in its cleaning cycle.



INSIDE FURNACE



ATOMIZED ALUMINUM



HOPPER FOR ATOMIZED AL
SPRAY HOLE AT FAR END.

The aluminum falls into fifty-five gallon steel drums sitting on a pallet which are taken by fork lift to different parts of the factory.

The dust is anywhere from twenty mesh down to at least two microns. Some will be sold to make metallic paint, brake linings and cinder blocks. This factory used four ball mills to make Al. for the painting industry and were adding another four. These four ball mills were all the same size. Aluminum for fireworks went into one of five ball mills. The smallest mill could hold and grind up to two MT of Al. at a time while the largest up to twenty MT. The grinding was continuous. These ball mills could be as large as one and a half meter in diameter by seven meters long.

One fifty-five gallon drum of atomized Al. was put into a room with control panels. There was a hole in the lid of the drum of about 20cm in diameter. A flexible metal hose was clamped to it then the powder was sucked out and into one ball mill in the next room. Each ball mill for fireworks Al. had it's own building and was separated from other mills and buildings by at least thirty meters. These mills were more likely to explode then the mills for the metallic paint industry. Al. for pyro is dry milled, while Al. for all other industries is milled with mineral oil.

In the control room there were metal cabinets with switches, dials and buttons. Here the mill was monitored to turn on or off as well as controls for water cooling, oxygen and nitrogen balance and for the vibrating screens. Only one man worked in that room. He was to make sure the computers didn't fail. Much of this is automated. With the use of sensors inside the mill, a computer adjusts the oxygen to nitrogen content. The air in the mill must remain between 8-9% oxygen, the rest nitrogen. If the oxygen content were to get too high or low the Al. would overheat and catch fire or blow the mill up. It is more dangerous if the oxygen drops below 8% then if it was over 9%. So far there hasn't been any explosions at either of the atomizing plants in Sivakasi.



SUCKING OUT ALUMINUM
For Ball Mill (Notice al. dust in air)



FIVE METRIC TON BALL MILL

Sometimes up to 2.5% Steric acid is added to the aluminum as it goes into the mill. The amount would depend on what they were making. One reason is to slow down the burn rate, it is known as coated Al. It burns almost as fast as uncoated. Having coated Al. is better for large explosions as it allows all the Al. to catch fire first before going off they said.

A water line ran atop the ball mills. This poured water directly onto the rotating mills to help keep them cool. A number of outlets for the water were spaced out along the length of the mill. At the bottom of the mill the water was collected inside the metal housing that covered the mill and other times just a trough. The water went outside to be cooled and used again.

When the stainless steel balls are first added to the mills they are seven millimeters in size. As they get used up they get smaller and every forty days during the plants clean up more steel balls are added. The mill gets filled 40% full of these stainless steel balls.

The mill will get filled half full of atomized aluminum for making plus 325 mesh. For making minus 325 mesh the mill will get filled with 25-40% full of atomized Aluminum. The powder exits the other end of the mill and eventually onto a stack of vibrating screens.

The screens are about a meter in diameter with the side wall made of brass. There will be at least three screens stacked up. What passes through the screens is done. Each particle size of Al. gets sucked up by a large metal hose and put into it's own fifty-five gallon drum. What remains on the top screen gets sucked up and goes back for further milling. From here a fork lift takes the drums of finished aluminum to another part of the plant for stabilizing.

The stabilizing part of the plant had four rows of closets all made of cement. Each row of closets were about fifteen meters long with up to fifteen closets per row. There were four fifty-five gallon drums in each closet. A small rubber hose was put inside every drum (all the way to the bottom I assume.) A rock was put on the steel lid to hold the lid down then Nitrogen was added anywhere from 4-10 days.



AL. STABALIZING CLOSETS



ADDING NITROGEN

Pyro grade aluminum there meant 85% passed through 325 mesh. This Al. looked noticeably darker and would take seven to ten days of stabilizing. The coarser grade of plus 325 mesh would stabilize in four days. If this nitrogen part was skipped the powder could catch fire because of all the freshly exposed surface. After stabilizing, the Al. would get taken by forklift to another building for packing.

The packing building was one giant room made of three walls and a high ceiling. The front wall was left open. There were about ten small work stations inside. One person with a simple cotton mask over his face put a large flexible tube into the top of one drum which sucked out the aluminum. This Al. was then put into a smaller thirty gallon drum which had to be returned to this plant. These drums had a different lid which could be taken on and off easily. The large fifty-five gallon drums were for the factories use only.

The lowest wage earner here made 100Rs (Rupees) per day or about US $2.10.



PACKAGING ALUMINUM

Aluminum Paste

Four new buildings were under construction at the other end of the factory to expand their paste production. This paste would be used to make metallic paint and other products. There were at least twenty men, welding, bolting and moving equipment around. When the new

buildings were finished, mills would be downstairs and presses upstairs.

The Al. powder would go into ball mills that were a meter in diameter by three meters long. Mineral oil would get added and the mills would turn four to seven hours. Unlike the powder meant for fireworks which goes through continuous milling, at the paste mills the powder would get dumped out all at once. Inside these mills there were small lifters and stainless steel balls.

Sixty percent of the Al. passed through 325 mesh when it first went into the mill. When finished, ninety percent will pass through 325 mesh. From there the Al. and mineral oil slurry went into a press.

Hydraulics held the press together. The press is one meter square by three meters long. It sits horizontal on the ground. There are thirty-one plates about four centimeters thick. The plates look like giant waffle irons. Sheets of heavy cotton are hung between each waffle iron and the plates are closed with hydraulics. The Al. paste slurry flows into the waffle irons from the top on one side of the cotton sheet. The oil flows through the cloth and out the bottom.



OIL SEPARATION PRESS

When the maximum amount of paste has been put in, the press stays closed for four hours. When done a worker opens the press, removes the cotton sheets and dumps the Al. into a barrel lined with plastic without the cloth. The Al. is now finished and ready for exported.

Back in the office we talked about shipping. It takes forty days to ship from Southern India to Los Angeles and twenty-one days to New York.

The owner and salesmen knew of Skylighter. Managers of other factories said the same. They never mentioned Firefox or heard of them. Most factory owners subscribed to American fireworks news, the business version

I was shown eight micron Al, which they said was imported. They wouldn't say where. Although I believe there are factories in India making Al. this small.

We would have gone to a fireworks factory that day, but this weekend was the state holiday. So instead the owner of the Kali Cock brand match factory showed up to give a tour of his plant.

Many firework factories were pointed out along the thirty minute drive. There was also the community college built and owned by Sri Kaliswari fireworks.

Within twenty kilometers of us, there were 300-400 firework factories.

The Kali Cock Brand Match Factory

The manager and two salesmen from the aluminum plant followed us by car. I rode with the match factory owner, who said "We have three temperatures in India, hot, hotter and hottest."


STICK MATCH FACTORY

The Kali Cock Match factory looked to be about twenty hectares. (Fifty acres.)

His brother was in charge of the back half of the factory where he would start making black powder in a month. He would then be the second only legal black powder manufacturer in Sivakasi. Because he's licensed he can sell to it anyone. Getting a license was simple, it meant you owned enough property to have enough distance from your neighbors.

The discovery of the first matches was in a town in northern China in the year 577. The Chinese there used matches instead of a pilot light as fuel was scares. Around 1910 a Japanese immigrant started making matches in Calcutta India. Then in 1923 factories started up in the State of Tamil Nadu where the climate was dryer. (Southern India where the city of Sivakasi is)

The Kali Cock Company has been manufacturing matches since 1975. Five years ago the new owner bought it and moved it to where it is now.

In the front half of the property there were four large buildings. No one was there that day because of the holiday. The owner asked me if the U.S. made stick matches. I told him, "I don't know." This owner, like most, spoke fluent English and was born in Sivakasi. He had never left India his entire life.

Around twenty-nine types of woods are suitable for making matches. The sticks Sivakasi match makers use come from trees south of the factory, in the mountains near the ocean. Kali Cock brand uses wood from Indian Aspen, Poplar and Mateel. However, woods from Semul (cottonwood), White Pine, or White Mutty are good quality for this purpose as well. Any wood that's porous, rigid and easily split will do. The sticks arrive pre-cut in large, reinforced, plastic bags.

From a nearby copper mine, phosphoric acid is purchased. They get it as a cheap by-product of mining that would otherwise be thrown away.



FULLY AUTOMATED MATCH HEAD DIPPER



MATCH HEAD DIPPER END VIEW

The small sticks are dumped into fifty liters of water mixed with two liters of phosphoric acid: about a five-percent mix. The phosphoric acid keeps the match heads from dripping while they burn. They are soaked for about a minute. Other countries that are more concerned with fire damages soak the sticks in Ammonium phosphate. This prevents the stick from burning after the wax has burnt off.

From there the sticks are put into metal trays and set outside on a cement deck to dry. This takes a few hours in direct sunlight. Four hours when it's cloudy; a full day of drying indoors when it's raining; and up to three days if it's pouring. At other factories, the drying is done in a rotating drum. In the rainy season, as with firework factories they stop work for two months.

The dried wood match sticks go into a large, rotating, polishing drum to polish off any splinters and to add paraffin. The paraffin helps the match sticks burn. The polishing drum creates a lot of fine dust. In the past, this dust could easily catch fire so everything that came out of the polishing drum went right into water until the invention of suction fans. When the sticks went into the water, they would have to go back outside for more drying. Now suction fans are used for the dust. "The wood dust is so fine and flammable that it can be used like sulfur, and blow up when confined." The owner said.

White phosphorus was used on the tips of strike-anywhere matches from 1826 to 1911. Now match makers use phosphorus sesquisulfide (a non-toxic chemical) and potassium chlorate as well as powdered glass, a few other inert fillers and a binder. Zinc oxide is added to the tip for a white color. While safety matches contain Antimony Trisulfide, potassium chlorate, sulfur, powdered glass, other inert fillers and a binder. The striking surface on the box is red phosphorus and powdered glass, with gum Arabic or other binders

From the polishing drum most of the match sticks are taken into the full production room. This is where everything is fully automated. While some matches go into a semi production room where part of the manufacturing is still done by hand. This is only because more automated machines have not yet been bought



MATCH POLISHING DRUM



MATCHBOX FOLDING MACHINE

Red nitrogen spray nozzles point to various parts of each machine to automatically put out fires. The red colored cylinder tanks along the walls of each room contained the nitrogen.

The semi production room was right next to the polishing room. Here the match tips are dipped automatically by a large metal conveyor belt into another coat of wax and then when dry into composition. When dry they are dropped into a tray. Men count each match by hand putting forty to a box. These men have been doing this for so long that they can tell you how many matches are in a box just by shaking it.

Similar to the semi production, in the full production room the sticks are dumped into a hopper which lines them up. A wide, perforated, steel, conveyor belt grabs each stick and holds it upside down while the tip is dipped into paraffin wax, dried and then dipped into the match head comp. The match tips take up to an hour to dry. The belt loops up and down several times inside the machine moving the matches very slowly to allow for drying. If the matches dry too quickly, they will not light properly. Part of this automation started in the UK in 1888.

When the matches are dried, a pin pushes them out from the metal conveyor belt. The matches are then counted by the machine and boxed automatically. Depending on the customer, some finished matches are not boxed, but put straight into bags weighing 35 kilos. Many 35kilo bags of finished matches sat in one corner of the factory. A bag this size is about waist high.

Match heads can come in many colors, such as yellow, black, green and red.

In another machine the thin, match boxes are printed, strike surface applied, cut, folded and glued together.



BLACK TIPPED FINISHED MATCHES



BOXED AND BAGGED MATCHES

We had lunch at the Bell hotel. The owner of the match factory, a salesman, the driver and Mr. Padbanaman of Sri Kaliswari aluminum. They asked me questions about fireworks in the US such as, "What licenses do we need? And what do we do with three and eight micron aluminum?" I told them "We make aerial salutes."

The food had far too many hot spices in it.

80% of the time there was no hot water at any hotel I stayed at. The front desk said "run the hot water for ten minutes", I did, but it was still cold.

In Sivakasi I found only two radio stations on FM and two on AM. But over sixty-five TV stations. At least nine in English, including the National Geographic channel, the discovery channel and the BBC. Along with U.S. movies in English and other US movies translated in Hindi.

After lunch I walked around the hotel. I was looking for a room on the other side, away from the temple bell that rang every morning at 5:30am. I also wanted to get as far as I could from the housekeeping phone, which rang in the middle of the hall on every floor, through out the night when ever someone wanted room service. This was common at any hotel I stayed at.

Varkala

Because of the closed factories that Saturday for the state independence day, I headed south to the beach.

Ravi of Kala fireworks instructed one of his workers to find a taxi driver that could speak English well enough to be my guide.

Even though it was only 300km, it took eight hours to drive because the speed limits were not more then 100Km on the open road and 80Km during construction. Towns in between slowed us down even more. The driver stopped, too, for his breakfast and lunch at restaurants along the way.

Varkarla was a tiny town with a population of only 200. It's surrounded by hills covered in a solid mass of coconut and rubber trees and is about 150Km North West of the very southern tip of India. It has only one grocery store and a few conveniences shops. None sell fireworks.

This was the off season. Summer is between November and March. Then this and other west coastal towns will be filled with lots of people from Europe. Swimming in the ocean was not allowed this time of year for fear of rough waters. Police walked the small beach to make sure no one went in the water. This was the only place I was not harassed by people walking around trying to sell me something. Nor were there any beggars.

My taxi driver slept in his car in a taxi parking lot. (Which was common.) Once again the five start hotel dinner had too many hot spices in it. Then the water in my room was brown and smelled of rust, sink and shower, but at least it wasn't cold. Every hotel I stayed at had to have a problem with the water: either it was too cold or leaking from under your sink, and in most cases, there was no pea trap under the sink. So every time someone next door flushed their toilet you would smell the whole sewer in your room for the next half hour!



VARKALA BEACH, SOUTHERN INDIA

In just four more days, there would be 1000s from all over southern India coming to this beach for the celebration of the dead.

Sri Krishna Chemicals and Fireworks Company

On Monday back at the Bell hotel in Sivakasi, I had picked what was the best room in the hotel. It was by itself on the top floor for $45 a night; the most expensive room and the quietest. No house keeping phones ringing in the hall outside my room all night and the windows were well double paned, so that I was never awakened from the Bell temple next door.

That morning I went with Raja the owner of SME Chemicals. He has connections to all the chemical producers in southern India, sells everywhere, and exports. He also has a patent on a pulverizer which will grind and screen soft

chemicals to 200 or 325 mesh. Many chemical factories there own and use his machine.


NITRATE FACTORY ENTRANCE


ONE OF 3 NITRATE DRYING PLATFORMS

We picked up the owner of Sri Krishna Chemicals and fireworks company at his office. Sri Krishna chemicals owns six firework factories up to twenty hectares each. They have around 600 employees in all and one chemical property where Potassium, barium and strontium nitrate are produced.

Trucks unloaded fireworks at the office warehouse as we left.

The factory was surrounded by tall dry grass in the country side. There were at least three manufacturing buildings and an office with a packing building in back. In front of each building was a 7m square, cement drying platform. This is where the chemicals would dry in the sun for two days. On cloudy days it would take longer. There was also a plastic tarp on stand-by in case it suddenly rained.

One building manufactured barium nitrate, another potassium nitrate, one for strontium nitrate and another magnesium shavings. Each building was used for making only one chemical. Chemical manufacturers not producing aluminum need lots of licenses.


CONVEYOR BELT TO MIXING TANK


ONE OF THREE MIXING TANKS


SETTLING NITRATE

In each building were bags full of carbonates or hydroxides from China. They were cut open and dumped onto a conveyor belt. Barium carbonate used to make barium nitrate. Potassium hydroxide used to make Potassium nitrate, and strontium

carbonate used to make strontium nitrate. The conveyor belt brought the carbonate up to a tank to mix with nitric acid for an hour. The walls of the tanks were stainless steel. The inside wall of the Strontium tank was lined with glass however. From the mixing tank this solution went into settling tanks. Each building had up to eight cement settling tanks with an open top. There was a very heavy smell of nitric acid in those buildings. The nitric acid would get reused. It was stored inside tanks behind the buildings.

This company receives 25MT of raw carbonates and hydroxide's from China per shipment.



POTASSIUM NITRATE



DRYING OVEN

Once the acid had settled, the nitrates were scooped up and put outside to dry. This will take them from 25% humidity down to 10%. From there they went into an outdoor oven.

The oven will take six hours to dry these chemicals down to 1% humidity.

From the ovens, the chemicals are taken to a building in the back and put into one of Raja's pulverizers. One will grind the chemical to 200 mesh and the other through 325 mesh.

After pulverizing the nitrate gets sucked up with a metal tube and dropped into a vibrating screen, then into fifty Kilo bags.

This plant manufactures 1,500 MT a year of Potassium Nitrate, 500 MT a year of Barium Nitrate and sixty MT of Strontium Nitrate.



NEW STRONTIUM MIXING TANK



NEW BARIUM MIXING TANK

The owner received many phone calls during this tour.

In a building in the back magnesium shavings were made with a lathe from cylinder, shaped, fifteen kilo ingots from China. The shavings will get used at the Sri Krishna's fireworks factory where they would get further reduced to 20-60 mesh.


MAGNALIUM INGOTS


AND SHAVINGS

In part three, we will visit a sulfur pulverizing plant, two magnalium crushing plants, the Sri Kaliswari fireworks factory and the Cornation Fireworks factory.

Sri Kaliswari Aluminum website www.Kaliswari-fireworks.com

There were no websites found for Kala Cock Brand Matches, SME Chemicals or Sri Krishna Fireworks.

ICE FOUNTAIN*

An ice fountain may also be described as an ice candle, sparkle candle, Dreamstar, Traumsterne or cake decoration gerb. It is a relatively small cylindrical fountain loaded with a nitrocellulose composition containing fine titanium granules to produce a spark effect. An example of an ice fountain functioning indoors in a lighted room is shown below (note the lack of visible smoke).

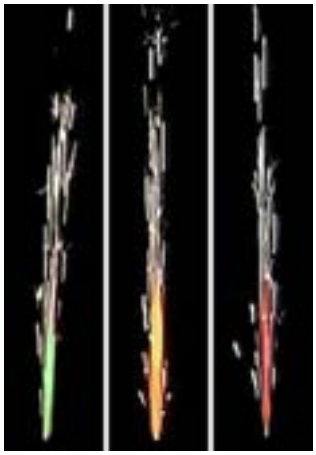


Photo Credit: **Rick Schwartz**

Examples of ice fountain devices that produce white and yellow sparks are shown on the left below. Some ice fountains, such as those shown on the right below, also produce a weakly colored-flame effect.



Ice fountains typically have a rather small internal diameter, a thick-walled paper tube and no *choke*. The colored units shown above have a tube ID of 0.3 inch (8 mm) and a wall thickness of 0.1 inch (3 mm). They burn cleanly with a relatively cool flame and make almost no visible smoke. Burn times are typically at least 30 seconds, producing a column of mildly branching, white sparks reaching nearly 2 feet (0.6 m) above the mouth of the tube. As shown below for green, yellow and red ice fountains, the color effect is noticeable but not impressive. (The exposure for these photographs was 1/60 second and the colors have been adjusted somewhat to approximate their actual appearance.)



The ice-fountain composition is loaded to the very top of the tube, where it can be easily ignited with a match (thus, normally, no fuse is provided). Some ice fountains may be fitted with a removable plastic cone that initially covers the top of the fountain to protect the composition and prevent its loss before use. Generally, this cone is meant to be removed and placed on the bottom of the tube just before use, where it functions as a spike to aid in keeping the device upright when placed into a cake or other penetrable surface.

Ice fountains are commonly manufactured in Europe, and now several Chinese manufacturers are producing them. Despite their jet of fire and spray of sparks, ice fountains are relatively safe and are generally acceptable for indoor use.

* Abstracted with permission from the ***Encyclopedic Dictionary of Pyrotechnics***. For information about this publication contact Bonnie@JPyro.com.

HOLATRON
Systems, LLC

Safe & Reliable Wireless Control Systems
Design & Manufacturing

- 25 years wireless firing experience
- First wireless system for pyro displays
- All products made in USA
- FCC certified
- High quality, low cost systems
- Spread-spectrum, frequency-hopping
- Ranges from 1/2 mile to 2 miles
- Rapid design custom systems
- Stocking distributors in US & Canada

Corporate WPA Sponsor

808-372-0956
Honolulu, Hawaii

808-732-5419 (fax)
www.holatron.com

EXTREME
Pyrotechnics LLC

FRIENDS OF THE FAIR



LAKE HAVASU CITY, AZ

PYRO Novelties, INC.
everything but the fireworks

That's Right....We're Moved!



(800) 552-3499
Closer than ever and ready to Serve you Better!

The Industry's #1 Resource for Apparel, Signs, Banners & Promotional Products



Custom Banners

Available in two sizes
$28.99 per case





Larger, Stronger Bag!
NEW
Support the National Council on Fireworks Safety by purchasing these bags!



16' Economy Wave Banner Flag Kits

Let us Promote YOUR BUSINESS!



PYRO NOVELTIES, INC.
11362 Strang Line Rd. • Lenexa, KS 66215-4041 (800) 552-3499 • (913) 469-8883 • FAX (913) 469-8885
sales@pyronovelties.com • www.pyronovelties.com



CSI

Combined Specialties International, Inc.
Insurance Brokers

Ask us how we can assist in containing your insurance costs
Visit our website: **www.combinedspecialties.com**

Debbie Merlino

Toll Free: 866-893-9510

E-mail: dmerlino@combinedspecialties.com