SPARK

The Official Newsletter
of the
UK Pyrotechnics Society

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The **UK Pyrotechnics Society** is the only independent UK organisation that exists to represent the heritage, science, history and art of pyrotechnics in the United Kingdom.

The society was officially formed in 2006, and consists of industry professionals, academics, and enthusiasts of the general public.

We are not a trade association, but represent the interests of a very wide ranging, vibrant membership. If you are not already a member, we invite you to read the newsletter, visit our webpage:

http://www.pyrosociety.org.uk

and perhaps even consider joining our organisation?

Steve Miller MIExpE. UKPS Chairman

Front Cover - WPA member shows her first four inch shell..

Photograph Peter Hand

SPARK - Issue 11

In this issue

From The Editor:

I make no apologies for taking up a large chunk of the magazine with the thought provoking article from Chris Case.

This was written in reply to a piece I wrote for the same journal. I have put a copy online here should you wish to read it:

http://www.pyrosociety.org.uk/forum/topic/6550-iexpe-article/

Given that we have at least one member facing possible prosecution at the moment I think it's almost compulsory reading.

If I'm allowed to, I will write a short reply, as I would be interested to know what the situation would be if the person under investigation had stuck to the letter of the law and created no nuisance or danger.

Given Chris's eminence in the this sector, I think the article does show that there is common ground and the 'authorities' are not all bad guys!

In complete contrast we have a piece from Peter Hand (a member in the United States) telling us about what you can get up to over there – be still my beating heart! Our Chairman has also provided us with an excellent piece from the world of special effects. It's full of interest and also shows us how much crossover there is from the professional to the amateur.

I apologise for the very late arrival of this issue, but it's due mainly to the fact that despite my chasing and announcements on the Forum, I received very little material this time.

I'm delighted to announce that Paul Dack has agreed to take over the vital role of treasurer from Joseph. Joseph is currently too busy to undertake the work. Many thanks to Joseph and best of luck to Paul – I'm sure he will do a great job for us.

Stop Press! You will find preliminary details of this years AGM on page 21. Please be there if you possibly can.

Phil Dunford Editor & Vice Chairman Editor@pyrosociety.org

The fine line of amateur pyrotechnics

by Chris Case PGDip GIFireE MIExpE

In the September 2012 issue of Explosives Engineering, Phil Dunford of the UK Pyrotechnics Society presented a fascinating insight into the world of the amateur pyrotechnician. One line stood out to me when Phil referred to raids being 'heavy handed' in dealing with garden shed experimenters. Speaking as someone who has been involved in a number of such actions, these are my own thoughts on the challenges and how we can work towards a workable solution.

Car explosion during training event.

Fireworks fascinate most people and have the ability to generate great passions, be they negative or positive, regarding this age-old craft of lighting up the night sky. The use of light and noise to amaze and entertain has existed for thousands of years. Indeed the Chinese used sticks of green bamboo thrown onto campfires to explode and ward off evil spirits; the account of Marco Polo of Cathay in 1295 talks of such items as they "burn with such a dreadful noise that it can be heard ten miles at night" and "anyone who was not used to it could easily go into a swoon or even die".

The creation of gunpowder using the ingredients of wood charcoal, sulphur and saltpetre, processed in defined proportions not only spelled the origins of modern warfare with firearms, bombs and rockets but also the ability to use such explosive materials for harmless entertainment.

But what is the defining line between such uses? When is a firework a weapon? How do we manage those who take great pride and skill in the careful manufacture of pyrotechnics and fireworks, recording and sharing the results with others in a large worldwide community? Can such a hobby be justified in the new world we all live in or would the abolishment of amateur pyrotechnics be a victory for the criminal and terrorists?

Any trawl through the video-sharing websites will reveal the results of what would be classed legitimate or the illegal use of fireworks both commercial and homemade. The internet not only provides the opportunity to share the results, but also the motivation and methodology to create explosive effects and in many countries it provides a route to purchase the component chemicals and materials.

Since the start of the fireworks crime team in Merseyside in 2004, we have dealt with over 500 incidents of illegal sale, use and manufacture of fireworks. Incidents have ranged from the 'traditional' fireworks through letterboxes to the use of large fireworks to create very effective car bombs. The multi-agency team has had high levels of success in reducing such criminal activities and protecting our local communities, with a range of responses from 'the friendly word in the ear' to a full scale joint investigation; the team has many tools and assets to tackle the problem. Seizing hundreds of tons of illegal fireworks and dealing with the offenders has seen such incidents reduced by over 80% in the past ten years.

The levels of training and awareness provided to Police and Fire Officers over the same period has dramatically increased; the team maintains a broad understanding of the trends emerging on the internet and regularly recreates explosive devices to examine the technology and provide guidance to investigating officers responding to serious incidents where fireworks have been used for criminal means.

However, the most technically difficult and perplexing incidents involve the amateur pyrotechnician, the person who makes explosive effects as a hobby and is only separated from criminality and perhaps terrorist activity by a single word - 'intent'.

Throughout my career in dealing with firework-related incidents, the amateur fireworks makers have presented the most taxing of incidents. Whether it is through direct operations or advice being sought over the phone by a concerned colleague, weighing up the risks to the community and evaluating the complexities of legislation; it can be difficult balancing act to manage.

The laws regarding explosives manufacture are widely different around the world, in the United Kingdom at this time the Manufacture and Storage of Explosives Regulations is in force after replacing the Explosives Act 1875 in 2005.

The basis for the 'Amateur Pyrotechnician' is that you can manufacture up to 100 grams of explosive for 'experimental purposes' without license or prosecution. Obviously if such materials were used to create damage, or injure someone (again the question of intent) then charges from Criminal Damage through to the Terrorism Act could be

considered. The Control of Explosives Regulations could present a recourse for the authorities to manage such activities; however whilst licensing is required to 'Acquire and keep Blackpowder,' no such controls exist on other pyrotechnic compounds, such as flashpowder.

Post blast forensics scenario fireworks device in car.

Looking at the potential cost to the public of the analysis and investigation of someone engaged in such small scale activities, would the prosecution pass the complex 'public interest' considerations by a Crown Prosecutor who may not be familiar with the matters of explosives?

However, how would the next door neighbour, concerned family member or professional carer balance what could be a harmless hobby with the risks associated? The sight of chemicals being mixed, items being set off in back gardens and general garden shed chemistry can appear less than innocent in the media-rich world we live in where precise details of terrorist bomb-making techniques are reported direct from court complete with colour graphics and expert testimony. To he fair, the hard work of Police and Security Services worldwide to educate communities as to the risks of terrorism enhances and ensures such awareness and the knowledge further protects our communities.

Usually at this time the concerned person contacts the authorities for assistance and advice, leaving the officer on the other end of the phone questioning if we are dealing with a hobbyist or a terrorist, and what actions are the best to maintain the safety of the individual and the community. The legal grey areas suddenly become a significant concern as the balance of safety and individual freedoms present a challenge to the officer sent to make a judgement call.

The Police in such circumstances face an almost impossible decision, to be accused of going over the top or underplaying the risks. This very much depends upon the risk perception of the accuser, if this should be through the media then the challenge grows.

In 2007, the team were contacted regarding the activities of a 93 year old man with advanced dementia. Living with his wife in a small terraced

house, the man was not fully aware of his surroundings but could clearly remember making small banger- type fireworks as a small boy. Small bangs came from the back garden as he would make his fireworks and then let them off for amusement. His wife said that it was the only time he appeared happy when engaged in this activity.

The carer spoke to the Local Neighbourhood Policing team, who immediately came to the fireworks team for some technical advice. A unit was dispatched to the scene to find a Police Officer in discussions with the gentleman's wife. Within the house we found the gentleman sitting on his armchair mixing small amounts of chemicals, all available from local DIY stores, a lit cigarette in an ashtray beside him. The man would mix small amounts, wrap in stout paper and then head outside to set off the firework. In this case it was obvious that the gentleman was a significant danger to himself and his family, but had not engaged in any criminal activity. He had legitimately purchased materials, mixed in small quantities which he let off in his own garden; apart from the aspects of a Statutory Noise Nuisance he was technically doing nothing wrong.

The carer and the gentleman's wife authorised the removal of the materials and a search was conducted to ensure nothing remained in the house that could be used for further fireworks. Military bomb disposal and Fire Service Hazardous Material assistance was sought to test and package the materials for transport and disposal, again through the authorisation of the gentleman's wife.

But the one thing common to all incidents of this type I have attended was the 'doorstep conference'. Police, Fire Service and Social Services gathered to discuss what, if any offences have taken place, and who has the power to do anything about it and protect the occupants.

Another example comes from a noise complaint in 2008. Neighbours were concerned as to the activities of a man living alone in a house in Merseyside. Small bangs, crackles and whistling noises would come from his garden and he often amused local children with his experiments. The team attended the property to speak to the man and investigate if any breaches had occurred of legislation. The eccentric male happily allowed me and a colleague into his house to show us what his hobby activities were - the manufacture of small amounts of blackpowder which he would form into bangers, gerbs and other pyrotechnic devices. He also had a passion for amateur electronics, his house was full of weird and wonderful contraptions including a video camera linked into the front door and a doorbell that announced a visitor's arrival by playing music all over the house.

Based in his small room which he shared with a pet rabbit, the man divided his time between his explosive hobby and the repair of TV's,

Fireworks demonstrations for Police, Fire and Military Officers to understand types and effects.

vacuum cleaners and other electrical items to make some money.

When dealing with the man, the issues behind this article dawned on me. We are sitting with a man who can very easily manufacture explosive components as well as the complex electronic systems to activate a device. He worked within the law, in fact he gave the team the benefit of a thirty minute lecture as to the finer points of explosives regulations, again studied over the internet and worked scrupulously to the law.

He had spent hundreds of pounds purchasing the materials for his hobby from the internet, a large number of companies provided him with such components and chemicals. Even Amazon will provide you with your chemical requirements now, delivered for the cost of a first class parcel.

It was plainly obvious that this situation had to be made safe, the man had a range of social and medical issues and it was difficult to predict what influences were controlling his behaviour, once again the matter of 'intent' surfaced. In this case we resorted to his tenancy agreement from his social landlord, prohibiting such activities within his home and he cheerfully offered up his chemicals and explosive materials for disposal. Hazardous Materials teams worked with the Military Bomb Disposal officers to identify categorise and package the materials for transport and disposal. What may seem as overkill to some is the sound basis of safe systems of work to others when dealing with the unknown.

This man presented a significant risk to himself and others who lived around him, not to mention the emergency responders who may enter such a dwelling, blind to the risks they face when endeavouring to deal with a 'basic' house fire, serve a warrant or provide medical aid.

Purchased chemicals stored in a bedroom

I have personally attended an incident where a fifteen year old boy lost a finger as he had ignited his birthday present from his pyrotechnics enthusiast uncle. When attending the place of manufacture we were faced with a very impressive operation where items were manufactured for entertainment, but one man's industrial strength hanger is another man's pipe bomb. The internet has effectively let the genie out of the bottle when it comes to learning how to manufacture many explosives, not just fireworks, so what can we do to control the dangers to those who enjoy fireworks as a hobby and those who live around them?

An interesting comparison can be drawn with the ownership of firearms in the UK, where following a number of tragic incidents many thousands of people had their legitimate pastime taken away in the interests of public safety; could the same fate be destined for those who draw pleasure in fireworks and pyrotechnics?

Both the experimenters and enforcers seek clarification and guidelines, dare we say a common sense approach? Colleagues in the Health & Safety Executive are engaged with all sectors of the explosives industry to review and refine the current legislation and I am confident that the situations described here will be managed and workable guidance produced.

As you can guess, there are no answers in these pages, only points for consideration and discussion.

Chris Case is Group Manager Merseyside Fire & Rescue Further information: chris@casent.co.uk

IF SPARK IS TO CONTINUE TO BE AN INTERESTING MAGAZINE, WE NEED MORE ARTICLES.

ANYONE CAN WRITE AN ARTICLE. HAVE YOU SEEN AN INTERESTING DISPLAY? DO YOU WANT TO TELL US ABOUT THE FIREWORKS OF YOUR CHILDHOOD? DO YOU WANT TO HAVE YOUR SAY ABOUT SOMETHING? DO YOU HAVE A TECHNICAL INNOVATION? DO YOU HAVE SOME GOOD PHOTOGRAPHS THAT YOU WANT TO SHOW? ANYTHING FIREWORK RELATED IS WELCOME.

THE EDITORS ARTICLE CUPBOARD IS NOW BARE. IT'S UP TO YOU...

Amateur Pyrotechnics in the USA

by Peter Hand

I've been invited to say a few words about my club, the Western Pyrotechnic Association or WPA as we are generally known. Aside from the national Pyrotechnic Guild International (PGI), there are a number of regional amateur firework clubs in the USA. In the southwest we have the Western Pyrotechnic Association (WPA), of which I have the honor to be a vice president this year. The WPA was founded in 1989 by a few West Coast pyrotechnic enthusiasts who decided a west coast based organization was long overdue, since PGI events are generally held in the north of the country, over a thousand miles from California and too far away and expensive to attend for most of us. We currently have about 500 members, the majority from California, though with a few from distant parts of the US and overseas.

Shell making seminar at Winter Blast

In the USA we have the advantage of a fairly permissive attitude to fireworks, nationally at least. The ATF, the Federal agency that regulates fireworks and explosives, permits individuals to make and use fireworks on their own property without an explicit license, subject to compliance with storage regulations, and ATF licenses are reasonably easy to obtain and quite inexpensive. Local state, county and city regulations are another matter entirely and many localities ban fireworks completely, except for fully licensed operations. That means for many people, official licensed club events are their only opportunity to practice the art. That is why we exist.

WPA holds two large events every year – Winter Blast in February, and Do It in September. Each of these runs four days. The emphasis of the two events is slightly different.

Winter Blast is the larger, and features teaching seminars and professional showcase displays as well as manufacturing. We hold it in Lake Havasu City, Arizona, which is on the Colorado river about 100 miles south of Las Vegas. It's a convenient distance from Los Angeles and southern California, and the weather in February is usually pleasantly mild and dry. Almost the entire membership attends Winter Blast, along with their families, so it's quite a large scale event. A great deal of commercial product is fired, and the showcase displays attract thousands of spectators. This is becoming a bit of a problem, as although we don't make any money off it, the city has been cashing in royally and the hotels have become very expensive that week.

Eight inch shell at 'Do-It'

Do It is smaller, and mainly a manufacturing event with no seminars or commercial displays. We hold this in Hawthorne, Nevada, a small town halfway between Las Vegas and Reno. Between 100 and 150 people show up and nearly all of them make their own shells and rockets, though there is some commercial product for sale too. Do It is a good deal less costly than Winter Blast, as you can stay in the local motel for five days for roughly the cost of a single night in Lake Havasu City, and the manufacturing hours are unrestricted. Together with the absence of small children and grouchy elderly fuse lighters, that makes it popular with members whose main interest is making stuff, and quite a few people have joined the WPA specifically to attend Do It. If I could only attend one event in the year, this would be my choice.

WPA also holds two small events, spring and fall, for really hard-core builders. Attendance is by invitation, limited to a couple of dozen, and spectators are forbidden. These are four day events held at a secret location well out in the remote desert where there is no water, no toilets, nothing there besides what you bring, and we leave nothing behind except footprints in the sand. They follow the tradition of the legendary outlaw Desert Blasts of the 1980s, and although now they're officially sanctioned events with permits, fees and government inspections, not all the anarchic joy has been lost. We occasionally get complaints about noise from the nearest town – more than twenty miles away. Well, it's quiet out there, and sound carries. That's our excuse anyway.

Although I realize this seems improbably expensive, I extend an invitation to UKPS members to come over and join us. A round trip to Las Vegas in February or September is one of the less expensive ways to see the USA – Virgin has direct flights – and the membership and event fees are less than you'd spend on a couple of Las Vegas shows. If we know you're coming, plenty of people would chip in with chemicals and supplies so that you wouldn't have to bring anything. This year we had one member who flew in from Australia just to attend Do It, and he had a blast. Come and see what you're missing.

Manufacturing at 'Do-It'

Experimenting with High Explosive Fuel Explosions for Movies and Television

By Steve Miller

(Reprint of an article written by our chairman for the Journal of Pyrotechnics)

Abstract

There are a number of 'brute force' techniques used within the Special Effects industry that utilise High Explosives to create the classic 'Hollywood' style fuel explosion seen in many a movie and television programme. Limited experiments have shown that application of techniques similar to those used in shaped charge anti-tank weapons (the Munroe Effect) can produce higher and larger fuel explosion effects, while using less fuel and explosive material, thereby creating a more controlled effect.

Introduction

As readers of this journal will probably know, the fiery explosions seen in movies and on television are unrealistic. The special effects (SFX) industry achieve these by using large amounts of fuel: petrol (gasoline), diesel, kerosene, alcohol or a mixture of these, that is thrown and spread by a suitable bursting/lift charge to create the classic 'Hollywood' explosion.

In the UK, High Explosives (HE), generally in the form of detonating cords, are the preferred bursting/lifting charge, however large maroons (salutes) are also used. Whichever bursting/lift charge is used, a secondary ignition charge (usually black powder or a similar pyrotechnic heat/flame source) is required to ensure that the atomised fuel is safely and reliably ignited.

These techniques produce a very satisfying 'Hollywood' type fireball explosion, and simply use the 'brute force' effect of the explosive material to burst a fuel container and/or throw the fuel into the air, forming a cloud of fuel vapour ready for ignition (by the secondary ignition charge).

As with any other force, when an explosive charge is fired to burst/lift the fuel, there is an equal and opposite reaction, which can do considerable damage to the local surroundings. The SFX industry tend to use kicker plates (Figure 1), mortar pots – for more directional bursts (Figure 2) or similar items to "Give the explosive something to push against" thus

protecting the immediate surrounding area.

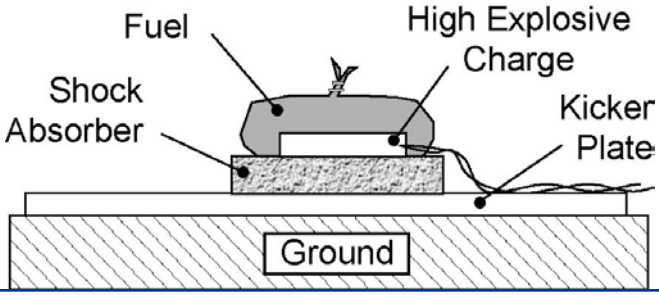

Figure 1. Example of set-up for a non-directional fuel explosion

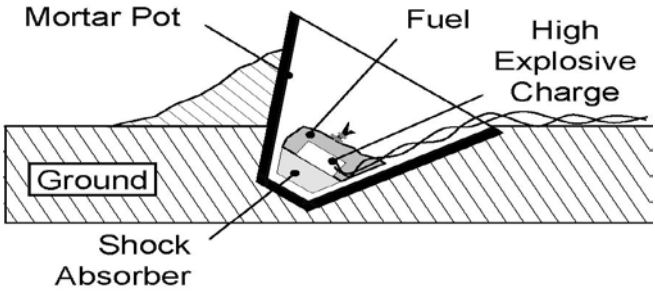

Figure 2. Example of set-up for a directional fuel explosion

A sacrificial shock absorber (such as firm foam) is needed between the HE charge and the kicker plate/mortar pot to prevent the direct transfer of shock waves into the metal of the kicker plate/mortar pot. Direct contact between metal and HE during detonation can cause metal fragments or scabs to break off and fly considerable distances.
However, HE has properties other than just sheer 'brute force', which may be harnessed and used with finesse to produce higher, larger and more controlled fuel effects while using lower amounts of fuel, thereby reducing the risk of secondary fires in the surrounding area.

Requirement

The requirement, and hence our experiments, originally came about through an enquiry from a conceptual artist who wanted to film a 100 foot high column of fire and project the footage onto the wall of a gallery as part of a piece of 'installation art' he was working on.
After an initial meeting it was established that the column of fire needed

to be 50 feet high rather than the stated 100 feet, as 50 feet would be the approximate height of the frame seen by the camera. A number of pyrotechnic based techniques were tried, but did not produce the volume of instantaneous rich fire in the column effect required. We eventually decided to apply shaped charge techniques in an attempt to solve the problem.

Experiments

An ideal experimental assembly was designed (Figure 3) that consisted of a hollow cylinder of explosive that could be detonated at one end, simultaneously around its entire circumference, with the central void being filled with fuel. The theory being that the contents of the central void would be compressed towards the central axis: As the charge detonates from one end, the compressed fuel is forced out through the open (yet to be detonated) end of the cylinder, thereby propelling the fuel high into the air. However, due to the complexity of achieving simultaneous initiation with the limited resources available a practical experimental assembly had to be designed (Figure 4).

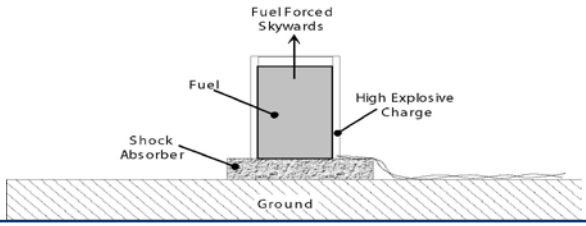

Figure 3. Ideal experimental assembly

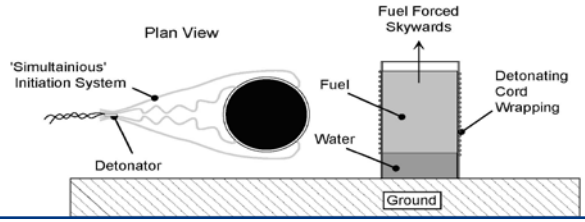

Figure 4. Practical experimental assembly

The assembly was based around a large diameter, thin walled cardboard tube, which was of a wound-laminated construction, having a diameter of 500mm, a wall thickness of 4mm and a height of 600mm.
The top three-quarters of the cardboard tube was wound with PETN

filled detonating cord (nominally 10 grams [150 grains] per metre), in a helix pattern around the tube with a pitch of approx. 30mm, this consumed 18 metres of detonating cord.
Four equal lengths of detonating cord were to be attached (using duct tape) at equal spacing around the circumference and vertically down the outside of the tube. These lengths would be bound together where the detonator was to be attached, such that the length of detonating cord between the detonator and the cardboard tube was exactly the same for all four pieces. This was designed to produce four simultaneous and equally spaced points of initiation around the diameter of the cardboard tube.
The bottom quarter of the tube would be filled with approx. 12 litres of water (inside a polythene bag). The presence of the water was designed to elevate the fuel and explosives thereby reducing the blast damage to the ground and surrounding area. In addition to this the water would be rapidly dispersed over the local area to reduce the risk of secondary fires.
The top three-quarters of the tube was to be filled with fuel; 12 litres of petrol (gasoline) and 24 litres of diesel oil. This mixture was chosen to give the required rich orange/yellow flame colour and good dark smoke to complete the effect, once the fire had died away.
In order to test the system cheaply a number of scaled down versions were manufactured. The scaled down versions were fired and compared with 1-litre versions of the 'brute force' techniques detailed earlier (Figures 1 and 2). These contained just 1 litre of fuel, however the scaling of the explosive content left us with just a single turn of detonating cord wrapped around the small scale cardboard tubes. It was realised that this 'simple scaling' would not give a truly representative simulation of the full-scale effect, however, it was felt to be sufficient to act as a guide as to whether the full-scale version would be a viable means of achieving the required effect.

Scaled Down Results

The scaled down 'compression tube' firings produced higher, tighter and more impressive looking fuel explosions than the same sized 'brute force' firings. The 'compression tube' firings also produced less damage and lower incidents of secondary fires. The results of the tests are documented in the series of photos in Figure 5. These results encouraged us and indicated that the full-scale version should produce the required high, dense and rich column of fire that had been called for.

Figure 5. The fireballs from 1-litre tests .The left-hand photo is from the non-directional fuel explosion (as per Figure 1). The middle photo is from the directional fuel explosion (as per Figure 2). The right-hand photo is from the 'compression tube' firing. The black outlines, were added before rendering the photos in greyscale, to better identify the extent of the fireballs.

Full Scale Experimental Firing

Following the small-scale firings a single full-scale assembly was built and tested: the cardboard tube was positioned and filled as shown in Figure 6. The four equal lengths of detonating cord making up the 'simultaneous' initiation system were carefully laid out, so that they were well separated and unkinked.

A secondary ignition charge, consisting of black powder and firework stars was attached to a steel post approx. 1 metre away from the full sized 'compression tube'. The secondary charge was required to ensure that the atomised fuel was ignited – the firing of detonating cord does not produce the incandescent sparks required to reliably ignite fuel mixtures.

A detonator was attached to the junction between the four lengths of detonating cord.

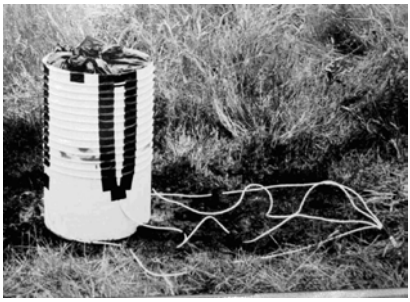

Figure 6. The first full scale experimental assembly.

The full-scale firing produced a dense and rich column of fire that was approx. 50% higher than the stated requirement of 50 feet as can be seen in Figure 7. Two, very successful, full scale firings were carried out in front of a child's 'A' frame swing and were filmed by the conceptual artist. One of these is now titled "Automation" and has been shown at an art exhibition in Barcelona.

Figure 7. Full scale firing.

UKPS 2013 Annual General Meeting

23rd March 2013
12-30pm for a 1.00pm start

The Henhayes Centre,
South Street car park,
Crewkerne,
TA18 8DA.

In line with our policy of moving the AGM around the UK, this is our first visit to the West Country.

The excellent new venue is within easy reach of the M5/ M4 so we are hoping for a good attendance.

We have some excellent speakers and events lined up and as soon as these are confirmed, we will publish them on the website.

Reserve a space in your diary for another great UKPS day!

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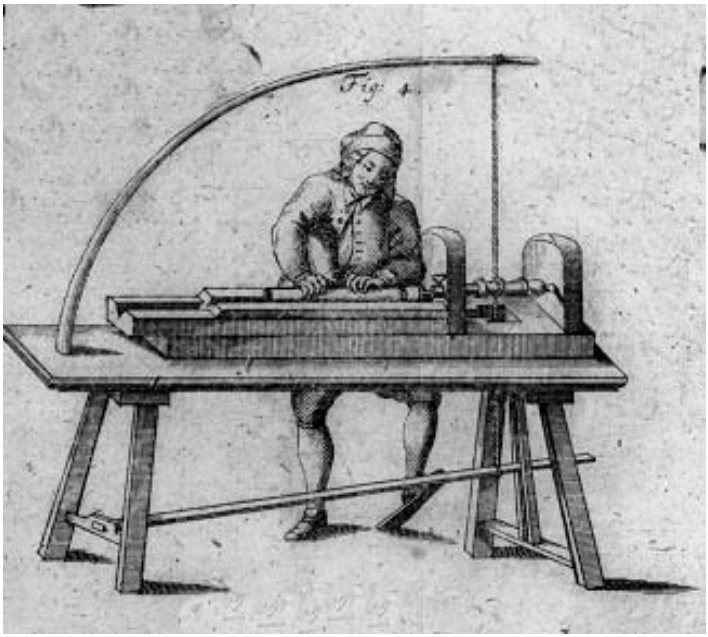

Luigi develops his patent, foot operated firework flinger

Firework Quote:

"We shall go wild with fireworks...And they will plunge into the sky and shatter the darkness

Natsuki Takaya

We welcome any firework related articles for publication.
Please send to:
editor@pyrosociety.org.uk

Remember to visit the Website and Forum for up to date information
www.pyrosociety.org.uk
www.pyrosociety.org.uk/forum

We now also have a Youtube Channel at:

http://www.youtube.com/ukpyrosociety

This edition is also being offered online – please see forum for details

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