

Fireworks

Principles and Practice

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4th Edition

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PREFACE TO THE THIRD AND FOURTH EDITIONS

The idea of this book took place more than 30 years ago, and it is gratifying that it still has a place in the world of fireworks.

The original intention was to produce a straightforward description of firework manufacture in the Western world. It was an attempt to describe what had happened in the past and to make suggestions for good practice at the present time.

It also was an attempt to be fairly basic and thereby not offend friends and competitors in the trade who had to make an attempt to make a living in fireworks. Amateurs have wonderful enthusiasms and, like true scientists, they need to know everything—for its own sake. They also want to share their findings with everyone else. However, this is in complete contrast to commerce, where survival may depend on the quality of the product or the price at which it might be produced. Needless to say, this advantage can be very costly in terms of hours of research and capital expenditure.

Recent years have seen the dramatic decline of the Western firework industry. The story is the same for almost every country where it has become uneconomical to make small fireworks compared to the price at which they can be bought from China. In the United Kingdom, for example, there were 10 manufacturers of small shop fireworks in 1960, but there are none left now. In the United Kingdom, only Kimbolton Fireworks makes a range of display fireworks, with two other firms making special effects for the stage. There also are a couple of individuals with licenses to manufacture from basic raw materials.

Much of the material from the Far East is inexpensive, and importers must be experienced to guarantee good quality. It also is a boon to the ever-increasing numbers of unspecialized (and often legally ignorant) importers who import explosives in much the same way as they might handle inert products. The Civil Service, in the United Kingdom at least, has been less than effective in the control of these illegalities in

recent years. They frequently plead the problems of open EC borders, but it was not so in the past, and while the EC gets the blame for most things, the United Kingdom goes the extra mile in gold-plating EC rules. On the other hand, it is clear that some of our partners in the EC have been much better at “looking after their own” than is the case in the United Kingdom. Oddly enough, in 2004 attempts at new EC standards for fireworks with committees dominated by bureaucrats from government departments and testing houses are further destroying the industry and making it unworkable and uneconomical.

This industrial decline is a great tragedy, but it is just possible that there will be a place for those manufacturers able to make a good-quality product—but for how long? Those people willing to make this capital outlay need a Civil Service that creates a level playing field. In 2004 a high-profile manufacturer is constantly bombarded with rules, regulations, bureaucratic nonsense, and more and more costs at every stage. Every sizable company has to employ unproductive safety advisers, subscribe to suppliers’ safety information—much of which is not applicable—and make space for records and risk assessments. Before a display on a roof in the east part of London, we had to spend time making risk assessments with no fewer than 10 interested parties. No one can deny that the *simple* desire for good health and safety management is laudable. In reality, it has become a burden, with those working in it leaving no stone unturned and sometimes reaching absurdum as they justify their existence. It is a regular joke that health and safety is the only growth industry that we have, and it is expensive too. Even the Bible indicates that things do not change very much:

Luke XI v 46 “Yes you Lawyers and Pharisees, you load men with intolerable burdens and will not put a single finger to the load.”

In the meantime, companies disappear or transfer their production to the Third World. All this time, the importers increase in number and have the financial gain.

It is difficult to predict what the next years will bring. Importations from the Far East will increase, but it is clear that there are too many Chinese exporters. Most of them are selling much the same products, and it is always more important to remain competitive than to produce superior products. A Chinese supplier may well sell the same products to several people in a limited market—a policy doomed to price-cutting—and in the United Kingdom the market is already saturated. The expertise of the EEC industry is already being lost. However, conflicts in the Middle or Far East could have dire consequences for imports.

Once again, I am grateful to the many friends who have helped to make this edition possible; in particular, to friends mentioned in Chapter 1 who have filled out the details about the firework scene in their own countries.

I would particularly mention Dr. Takeo Shimizu (b. 1912), whom I have known for more than 30 years and who has been absolutely prolific in his research for the firework trade. What would we have done without him?

Mention also must be made of the late Chris Philip, who died in January 1998. The importation of fireworks into the United Kingdom had always been a major problem because of the prohibition on the admixture of chlorates and sulfur. However, Chris Philip set out to challenge a somewhat negative attitude toward importation at that time. A total ban had been easy to control, but his success has done no favors to the home-based industry some 30 years later. The British Standard for Fireworks created a flurry of activity at the time, but the government has not been particularly proactive in controlling the quality of what can be sold from abroad in recent years. Some of the fines seen in other parts of the world might clarify a few minds.

Sadly, the firework world lost George Plimpton in 2003. A journalist and lifelong firework enthusiast, he was much better known, revered, and respected in the United States than elsewhere. Nevertheless, he created a place in the firework world for his book *Fireworks: A History and Celebration* (37).

Nearer to home, I am grateful to Mark Lancaster, elected a member of Parliament in 2005, Dr. Tom Smith, Tony Cardell, Roy Butler—my old teaching colleague and friend—and John Bennett, the editor of the excellent UK magazine “Fireworks.” This magazine has done much to encourage an interest in fireworks and to keep the available history intact. But also to my wife, Kath, who tends to see herself less as a “firework widow” in these latter years but who has always maintained that I eat and sleep fireworks and talk about them—but less so—in bed these days.

I also am grateful to my son-in-law, Stuart Adlam, architect by profession but now our Commercial Director, who has been so helpful revising photographs and drawings, revising a disc, and telling me what to do when the computer asks awkward questions.

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SIXTY YEARS' LOVE OF FIREWORKS— DIAMONDS IN THE SKY

Ron Lancaster

Yorkshire in the United Kingdom used to be the center of the firework industry in the north. We are not exactly sure when it seriously started in the middle of the nineteenth century, but it almost certainly was connected with the mining industry.

At the foot of the Pennines, Huddersfield is a town that grew with the Industrial Revolution. It grew around the River Colne but is surrounded by hills and magnificent scenery. Quite near to where I lived, at one of the high prominent points, there is a tower that was built to celebrate the Diamond Jubilee of Queen Victoria. From that point it is just possible to see the Standard Firework Factory on a disused quarry site, as the hills slope upward toward the Lancashire border. One or two miles to the east from my house I could see the Lion Fireworks Factory, which had grown from the first beginnings with Alan Jessop in 1847.

As a small boy, just eight years old in 1939, I found that fireworks were fascinating. On the way home from school around November time, we would go into the local bakery and general store and, after lovingly admiring all the wonderful shapes and colorful labels in the glass case, we would select one or two as our pocket allowed. Each night we would bring out the growing collection and play with them, and the fact that the colorful Witches Cauldron cone was leaking silver aluminum powder did not matter. There was little central heating in those days, just open fireplaces, and, needless to say, we did not take Dad seriously when he said that if we did not put them away, he would throw them on the fire back.

The wife of the man who delivered the coal worked at the firework factory, so we also had the benefit of buying a nice selection box at a good price. There is just one other memory of this early period when I was taken up the Castle Hill to see the big display that was put on in 1937 for the coronation of our much loved George VI. Sitting close to

the biggest firework display I had ever seen, the impression seems to have been far-reaching.

November 5th was a lovely family day, when family and perhaps some friends gathered around the bonfire that had been carefully built over the previous weeks. Sometimes it was built more than once if some little monsters nearby had raided yours when you were not looking, and on some more nasty occasions it got set alight prematurely. Our local vicarage was surrounded by many mature trees, with the result that the vicar trimmed them at this time so that the local lads would tow the branches away.

The party always had to be accompanied by food, of course—sausages, treacle toffee, and Parkin, which was a kind of oatmeal sweetcake made with molasses. We even played little games like “apple bobbing”—extracting an apple floating in a bucket of water only with your mouth. It was an enjoyable family occasion that was not too noisy—a far cry from the year 2000, when the noise from Chinese material can make some people feel as if they are under siege.

The arrival of World War II in 1939 on September 3 had little impact on a boy of eight, but it had serious consequences for the firework manufacturers, whose magazines were full to capacity. The fireworks were all ready for distribution for November 5th, but they were destined to stay there until the end of the war in Europe.

The financial consequences for the various family-owned businesses, unable to sell their stock, the problems of insurance for storage, as well as the need for storage for work to come, can only be imagined. No provision had been made for war work, and other work had to be found for those who had not been taken for the forces or other war work. For a time Standard Fireworks made blinds and lampshades out of black paper for the mandatory “blackout” for protection against aerial attack. They also continued to make indoor fireworks and sell them for at least a season, but after a period, contracts were set up with the Ministry of Defense to manufacture such items as practice ammunition, Very pistol stars, Thunderflash sticks, and parachute flares.

For those of us who were at school, it was the parachute flares that created the most fun. Huddersfield had an excellent trolley bus system that covered the whole borough, and children could get a one-penny return ticket (a sum of money a mere fraction of a cent and virtually worthless today) with which you could travel anywhere in the large borough.

In waterproofs and rubber boots, we used to go up to Crosland Hill and about mid-morning run through the heather to catch the silk para-

chutes that gently floated down after the sodium nitrate/magnesium flare had burned out. If you had a long stick, you could hook a parachute before some other “little monster” who did not have a stick. On the other hand, as you start to ascend the Pennines at this point, the weather and the wind in particular can be quite a problem, so we could be traveling any kind of distance through the moor. On rare days the parachutes would land in the town itself. A school contemporary became a distinguished runner, but it was the pyro that inspired me, and we were delighted on the rare occasions when we found the odd unignited flare that the searchers had missed.

Naturally, our interest was sporadic, for the variety was not great and when we had seen a goodly number of Very stars and Thunderflashes at the Lion Factory, it became somewhat boring. Goodness knows what the reaction would be today when people even complain about church bells.

May 8, 1945 saw the end of the war in Europe, and the country burst into jubilation with music, dancing, and, of course, fireworks. It often amuses me when people ask if fireworks have a shelf life, but we can assure them that material made in 1939 was still fine in 1945. The labels still had the prewar prices, but a percentage was added to cover storage costs and insurance over five years. However, these sales also created a scarcity, and there was not enough time to manufacture for November. In fact, it took some time to organize firework production as some military work continued and materials were in short supply. Food was still scarce and as some wheat flour was used for making some fireworks, I seem to remember one company being prosecuted for using it. I remember the rationing of sweets as late as 1952 at university.

A characteristic of many amateurs is the assumption that the sight of a formulation and the purchase of some chemicals will enable them to make a firework; they can also be quite disappointed with the results. When my cousin and I began in the 1940s, we had the added disadvantage that chemicals were not so easy to procure. We could get potassium nitrate and sulfur, but we had to make our own charcoal and potassium chlorate. The pharmacy charged six old pence for 28 g of potassium chlorate, but for that money you could buy two meals from the local fish and chip shop. On the other hand, sodium chlorate sold as weedkiller was much cheaper, and in those days it was not adulterated with phlegmatizing chemicals. We calculated the quantities required from the equation to mix sodium chlorate and potassium chloride (used as a fertilizer) and mixed the hot saturated solutions to make potassium chlorate; the yield was quite good and we became quite efficient at recrystallization.

We also became quite skilled at distilling charcoal in sealed treacle tins, very quickly realizing the different kinds of sparks and burning speeds that can be obtained from different kinds of wood. It was also possible to get good willow charcoal powder from the pharmacy since they still used it occasionally in medicine. Aluminum was obtained from the larger paint dealers, but magnesium was much more of a problem. Occasionally we got some magnesium block to file down.

Oddly enough, we were not interested in making bangs; it was rockets that we spent most of the time investigating. One or two of the old books had furnished tube and spindle sizes, but we concentrated mostly on the English 4-ounce size with some degree of proficiency. Sadly, as all amateurs discover, it is the consistency of the burning speed of the powder that is all-important, and this cannot easily be achieved with small batches. Nevertheless, we learned a lot from the experience and, as is so often the case, the end of the war, the availability of fireworks, and the need to work more seriously in preparation for university contributed to a slowing down process—but not entirely.

Huddersfield Railway Station has a wonderful classical facade that has made it quite famous in railway architecture. As you got off the train, there was a huge hoarding that said “Huddersfield, The Home of Standard Fireworks.” Steam was coming to an end, but I can still smell the steam and the soot from those huge locomotives as they entered the station and their high-pitched scream as they let off the excess steam. On many occasions we were going on to Manchester through the tunnel under the Pennines to a place called Belle Vue.

Brocks had a permanent site in this old world pleasure garden with regular displays in that postwar period. It was old-fashioned U.K. manufacture at its best. At each end of the raised “stage” there were sheds where huge lancework devices on wheels could be made and kept dry. When required, they were simply pushed out on the rails and ignited. There were battle enactments, trains, volcanic eruptions, saloons, and walking cowboys with guns. The best piece was the Weird White Waterfall, which stretched across the whole site. The waterfall sticks each had an electric igniter, and they were placed along a wire that could be kept quite taut as it was controlled with a winch. Two loud maroons and two large-bore military whistles created the stunning effect of instant ignition and silver drop. You were scared out of your wits with the bangs and tortured by the beats from those large whistles.

A body of water separated the audience from the firework arena, and it was this that gave a suitable and convenient distance away from the main fireworks, but it did not stop the shell hemispheres from dropping

into the crowd. In those days papier-mâché shell halves were only lightly papered and glued together, with the result that it was not uncommon for 200-mm hemispheres to fall among us. We were never aware of anyone being injured, but it makes you think now when people are ready to complain over the smallest of matters. One feels that if they saw fireworks in some parts of the world, they would almost have a heart attack.

Looking back, it seems almost unbelievable that by the time I arrived at the University of Durham in 1950, it was going to be the end of my contact with fireworks for seven years. Apart from the University Regatta, I hardly ever saw any firework displays, and I certainly did not realize that one day I would be returning to that site to actually put on a display.

After three years at Durham, two on military service where I was expected to have an interest in the 25-1b guns in the Royal Artillery, I went on to study theology for two years at Oxford. Cuddesdon College was founded after the Oxford movement in the nineteenth century and was associated with quite a number of well-known figures in the Anglican Church.

It is apposite at this stage to mention this later display in Durham, which was for the 150th anniversary of the founding of Durham University. Although it had been a seat of learning for some hundreds of years, it did not actually become a university until this later time. The display was on the traditional site of Bede College, but at the end of the show there was a little meeting between the principal of the college, a Cuddesdon friend of mine, the Archbishop of York, and the Archbishop of Canterbury, both of whom had also been at Cuddesdon—and myself. The main difference was that they were suitably dressed while I was somewhat covered with carbon and perspiration!

This was not the only time that I had found myself in this position with the well-loved Archbishop Runcie, for I have also presented displays on two occasions for the ten-yearly Lambeth Conferences for the Anglican Bishops from all over the world. Mark Lancaster and I well remember the ending of the first of these two displays when Archbishop Runcie took us to a meeting of all the world's archbishops where Mark had to explain to the famous Desmond Tutu what we had been up to.

Ordination in 1957 meant a return to Yorkshire to work in an industrial parish. Morley was a town that had specialized in making an inexpensive kind of blazer cloth and also happened to be quite well-known for growing rhubarb. There was a very large youth club attached to the

church and, as we had little money to spare for fireworks, I decided to make some of my own once again. To the relief of my landlady, the vicar's garage provided a suitable venue. More importantly, it was not too far to Huddersfield and it provided the opportunity to make contact with the firework trade there. The Lion Firework Company and Standard Fireworks were extremely friendly, and it did help that Richard and Edward Greenhalgh at Standard Fireworks were both dedicated churchmen.

Although I did not quite realize it at the time, these two men, along with Joseph Seymour at Lion, were to give that extra helping hand to bridge the gap that exists between amateur and professional practice.

Although the Lion Company was more than a century old, Standard had grown out of Lion at the beginning of that century to become, through remarkable effort, one of the largest firework makers in Europe, employing well over 500 people.

Standard did not really expand from smaller beginnings until 1922. James, the father, along with sons Edward and Richard and daughter Kate, built up the business with complete dedication, rivaling Brocks and Pains, who had most of the market. By 1939 they had as much as half of the U.K. trade. James was 79 when the war began, the magazines were full to the brim, and there was a huge overdraft with the bank. For a while only indoor fireworks were made, but the filling of 1" and 1 1/2" Very cartridges started very quickly and as materials became more scarce the indoor fireworks came to an end—never to recover properly again. The value of the stock and the purchase tax was frozen during the war, but a percentage increase, got rid of the bank debt.

By the standards of today, the Greenhalgh family would be regarded as excessively paternalistic, but their devotion to the Christian work ethic, their support of those associated with them, and their friendliness to me will never be forgotten. Just before "Mr. Edward" died, he sent for me and, as I talked to a very sick man in the garden, I was moved by his compliments about the work I had been doing.

A move in 1960 to a very different parish in Harrogate enabled me to build a small laboratory in the parish house. No one seemed to be much concerned except one of our choirmen, who happened to be an insurance assessor! He did not make too much of a fuss, but I suppose that if we had caused a fire, it was fairly obvious that the insurance would have been invalid. Looking back, it was somewhat naive, and even the police were happy to supply me with licenses for gunpowder.

After six years as a curate and the refusal of the offer of two university chaplaincies, I applied for the post of chaplain at Kimbolton

School, which is about 100 kilometers north of London. After the usual discussions about teaching divinity and chemistry and where I was to live, the headmaster asked if there was anything else. I asked him if there was anywhere that I could build a firework laboratory and waited for him to fall off his seat.

While I knew that the main part of the school was housed in a Tudor house largely rebuilt by Vanbrugh and Adam, and even that Queen Katherine of Aragon had died there after Henry VIII had got rid of her, I did not know that Sir John Popham also had lived there and that he was the judge at the trial of Guy Fawkes!

Amazingly, the headmaster told me that there was a suitable high-walled vegetable garden that had once belonged to the Duke who had formerly lived in the castle and that I could use that.

Applications to the old Home Office Explosives Inspectorate drew a polite refusal, but when I made the point that, provided the provisions of the law were met, a refusal might be unlawful, Dr. Jim Jeacock came to see me. We got on well and he was extremely helpful in ways that I had not considered. Now long in retirement, we are good friends to this day. One very helpful suggestion was the information that there was a firework factory in liquidation in Suffolk and that we might negotiate a couple of workshops from there. We did, in fact, get two brand new ones and with some of the pre-university boys and a flatback truck, we went over to Suffolk and brought them to Kimbolton. There was just one other thing bugging me, and that was the proximity over the high wall of a small Roman Catholic chapel used on Sundays. Clearly, it was too near for the U.K. Acts, and I well remember Dr. Jeacock's words, "You are not going to make fireworks on Sunday, are you? No, well then forget it."

There also was a tinge of sadness. I was not going to find it easy to get back to Huddersfield, but a strange coincidence came about. As I was occasionally in south London and quite near the old Pains factory in Mitcham, I wrote to ask them if I might visit them and see their plant.

John Deeker wrote back to say that he would be glad to show me around, and shortly afterward I went there to meet them. They had just been taken over by British Match, whose chief chemist happened to be there, which led to some interesting discussions about mutual problems. Soon afterward I was asked to work with them as a consultant, a job that was to last from 1963 to 1977. We have often laughed afterward about that first visit. It appears that the senior director (former owner) Philip Milholland had thought that it was a waste of time to show a parson around the plant, but John Deeker had disagreed, adding

that he probably was a nice old man and that he would take him around. However, they were somewhat surprised to find that the old person was the same age as John Decker and Tony Little—32.

The sad part was that it had to mean a break with Huddersfield, and it took a number of years for the rift to heal. I also was just beginning to realize that commerce and the amateur world are very different places. Looking back, it was at this time that I became involved in another political situation when I was staying with my old friend Lars Barfod of Tivoli Fireworks in Copenhagen. We went over to see a factory in Sweden for fun and interest only to find that I was unknowingly treading on dangerous ground involving competition with signals. Now it is ancient history and once again my Swedish friend Björn Söderberg and I can look back and laugh about it.

It took just about a year to get the explosives license, which arrived in September 1964. The new “factory” consisted of two buildings, one for chlorates and one for sulfur, and a concrete gunpowder store. It allowed me to work with about 7 kilos of composition and 35 kilos of gunpowder. In the course of time, we added a third building for assembling fireworks and two storage magazines further away from the community.

It is inevitable that I did not hear all that might have been said about placing such workshops quite near the center of the village, but the media produced misleading headlines such as “Firework Factory in School Grounds” or “Firework Factory in Back Garden.” The school owns much of the former Duke’s estate, which was considerable.

All was well for a while until the school bursar began to be alerted to potential insurance problems. We thought that we had fixed this, for I managed to extend my household policy with the Ecclesiastical Insurance until they sent an assessor one day. They asked me to find another insurer, adding that stained glass windows and organs were more in their line, and this was when we turned to Pains for help. In time, even this was a problem (and insurance was no problem in those days), and the issue was precipitated by the Queen’s visit to Nottingham at the time of the Silver Jubilee. I had paced out the distance of 100 meters from the fireworks to the official party and allowed for the prevailing wind, but it changed and we dropped a spark on the mink stole of a prominent lady who had borrowed it for the night. The cost to repair it is insignificant today, but there was an argument not only with insurers but also about a little old lady much farther away who had got some hot dross on her cardigan. She wanted a new cardigan and was not concerned about the small blister on her arm! How

things have changed in the insurance world, but at least we found a new way to insure with Lloyds through an old boy of the school and we were settled for many years to come.

The early 1960s were a period of research and consolidation, but big changes were afoot. The first signs of terrorism meant that site security was becoming tighter, and marriage in 1966 meant that the firework activities would have to fund themselves. It was decided that with the help of my geography teaching colleague, Roy Butler, we would do a few small displays in order to break even. Roy had arrived at the school a year after me, knowing nothing about fireworks, but he soon found himself making Roman candles and has done so ever since.

But there was another more sinister factor in the late 1960s. There had been a number of accidents with domestic fireworks as the industry grew after the war, and these were highlighted by a BBC program called "Man Alive." Presented with a very definite anti-firework slant, for a number of years it managed to polarize people—for and against—and tried to give the impression that organized displays were essential in the future. While this was good for us, we were not in agreement with the view and there was the fear that if they won this battle, they would turn their attention next to those organized displays. To some extent that did happen, but by the time the borders of the Common Market were opened, there was a blossoming of imports from China. Some old U.K. firms disappeared, while new purveyors of Chinese material started to create some of the old political problems again.

The anti-firework campaign led to a sharp decline in retail turnover, and from that time some smaller companies went out of business. James Arthur Kilner, the director of Lion Fireworks, decided to close the business and realize the assets, so 120 years of trading came to an end. By 1970, the Wells family also decided to call it a day. Sad as this was at the time, it was not all bad since Kimbolton was able to purchase considerable quantities of materials and tools and acquired quite a number of large displays at a time when we wished to expand.

Kimbolton exercised very little commercial activity in the 1960s, mainly because we were all working schoolmasters, but we had a distinct advantage in that, teaching in an independent boarding school, once we were off duty, we were free. We might well teach until 4 p.m., work in the workshops until 6 p.m., and then go back on duty until, say, 10 p.m. or sometimes until the next morning in a boarding house. Most of the displays were in the summer vacations and we did not have to commute to work. It was ideal.

Only once did we ask for a day off from school, and that was to put on the display for the 25th anniversary of the Coronation of the Queen in 1978, a year after her accession. If we had a show on a weekend in term time, we loaded the van after school on Friday, taught Saturday until lunchtime, left to put on a display after lunch, returning at 12 midnight and often later. Sunday morning was chapel, so the van was unloaded after lunch in time for tea and evening chapel. Needless to say, this routine only took place in the latter part of the summer term or around November. From the late 1960s this was a regular pattern and the business escalated.

Oddly enough, the first public display was put on by my colleagues as Kath and I were on our honeymoon. Domestic issues were already changing, and I was no longer allowed to keep a small amount of gunpowder in the house in a bread bin. As Kath would say today, she did not realize that from time to time she would become a firework widow. The nearby town thought that they could no longer afford Brock, and this was the reason we took on the show. However, we had our eye on Brock's show at Northampton, which, like many of his shows, was very ground "set piece" based, and we wanted to replace it with a more visible aerial display. They were a bit unsure then of a (possibly) eccentric Reverend, but it all changed in a strange way. The corporation has a fine suite of public baths, and one day, along with one or two colleagues, I realized that the man who organized the show was sharing the steam room with us. A whispered comment to persuade him while he had his pants down worked, so we took on the Northampton Show as our first commercial display in 1978.

It has already been mentioned that the late 1960s was a period of learning, and I have recorded my gratitude to Willy Stott, the display manager of Standard Fireworks, a man who loved fireworks and who taught me much of what I know about the old ways. He helped me even after he retired, because he wanted to do so, and I can still see him ill with a colostomy battling with a 5-meter lancework frame in a force 8 or 9 gale on the sea front at Blackpool. It was being televised by the BBC for a Miners' Gala. In the early days Willy and I had spent many happy hours at displays, which were then done by Standard for the Edinburgh Tattoo, in Ulster, and elsewhere.

This early period was also notable for the influence that German firework makers brought about. Again, I am grateful to Richard Greenhalgh, who pointed me in that direction as he had worked for some time at Silberhütte between the wars. On my first visit to Germany this was now part of the eastern zone, so I went to Eitorf

instead to meet Hermann Weber and his chemist, Mr. Freisinger, both of whom had originally been with the firm of Nicolaus at Meiningen, also in the East. They called the firm Pyro-Chemie (now Weco) and were very kind indeed, but I shall never forget the first visit in 1959. On my way to Siegen, I waited at Köln for a train but could not believe my eyes as a battered old steam engine pulled alongside the platform. We meandered down the River Sieg and at Eitorf, found that the station was not rebuilt and that I had to jump down on to the line. It is somewhat different today.

Gratitude also is due to Fritz Lünig, who took me around with him to some of his displays and probably thought that I was a bit of a nuisance wanting to know about everything. Amateurs can never fully understand that their genuine interest may be suspect, and I have learned my lesson over the years. However, I am sure that the test of time has proved that a thirst for knowledge has not seriously damaged their businesses. I have much to thank Germany for: many fine contacts that have been made, particularly in recent years with Walter Zink of Cleebrohn.

I joined the old firm of James Pain as a consultant in 1963 just in time. The old factory was getting hemmed in by a school and other buildings and part of the testing site was a graveyard. The closure of the plant to join with the rural Wessex factory made much sense, but, sadly, few skilled workers were willing to make the move from suburban London to rural Salisbury. However, the experience was invaluable and welcome. Being a consultant is a kind of balancing act because you are not really one of them. Appearing out of the blue every few weeks makes it difficult to be a part of the team, and when things do not work out, it is obvious that the blame falls on the person who is not present. Sometimes it was necessary to get changes made by either convincing the management that it is necessary or doing it by stealth. An example would be a blue star. At this time the formulation was not very good and suddenly the shells started detonating. It quickly became clear that the stars were crumbling to dust because whoever had rewritten the mix card had reduced the amount of dextrine. A suggestion that my formulation should be used prompted the reply that they had tried it and it would not dry properly. However, the factory made all my stars for my private use at that time, and I pointed out that, unknown to some, they had been making this formulation for me for some years, but not using them in normal production. Such is the human factor in a very conservative industry.

Serious explosions do not often happen, and when they do it is not always easy to know what the cause might be. One such explosion hap-

pened as people were arriving at work one day. A brick drier exploded and it contained magnesium flares in addition to whatever had caused the exothermic reaction. Burning flares along with masonry were thrown about, creating considerable damage, but happily before the factory had started production. It was a year or two after the death of an employee that our suspicions led to some clarification.

A key figure at Pains-Wessex in this period was a delightful man, Gordon Curtis. Gordon had worked since the war on smokes in particular and had always been referred to as the "Smoke King." From smoke on airplane wings in the early days to screening smokes and latterly for distress signals and insecticides, he was the expert and it was a delight to know him. The introduction of fireworks into the area was a fascination to him, as were all things pyrotechnic, even making the torch for one of the Olympic Games. Quiet in manner, Gordon wanted to hear other opinions about the subject and was always willing to share his experience. We have always said that fireworks are a mixture of chemistry and cooking, and as it happens he was an excellent cake maker.

Toward the end of the 1960s Pains-Wessex decided to take part in some of the European firework competitions, which were just beginning to gain in popularity. In 1968 it was decided to go to Cannes, but apart from Cowes, our experience was limited to firing off barges by traditional methods. Cannes presented a real challenge as it involved the coordination of three barges in the sea. By the evening we all felt ill as we had been gently rocked on the sea in the blazing sun and the primitive electrical firing system was useless. It was quite embarrassing, but at least we did not pound a barge so much as one company was said to have done, causing it to sink.

We got an award for the best color and, with my heavily pregnant wife on my arm, I cannot think now why I attended the award ceremony wearing a clerical collar. This was somewhat emphasized by a "lady of the streets," who tried to take my arm as we entered the building. Not again until 2001 did I go to Cannes when Kimbolton took the first prize and the Winner of Winners in 2002.

The Pains-Wessex display at San Sebastian in 1968 won the first prize. At that time many military noise units were being manufactured, and I recall large old-fashioned round shells being stuffed with these magnesium flash compositions to produce an absolutely stunning finale. It also appears that in excess of 100 marine parachute flares in red, green, and yellow was something special for the judges.

A year later we had a problem with smaller magnesium flash charges. The composition is so brisant that the Bickford fuse and the

closing cork in small Roman candle flash units require no glue. The extreme pressure in large mine bags is another matter, and it was at San Sebastian that wooden crates of mines blew up into a mass of paper and wooden pieces. I was lucky to get caught only in the back.

It was a great learning curve, and there is insufficient space to include all of the fun. There was the drunken, swearing boatman who rowed us back over the river at Salcombe at the end of the show, wondering if we would need to swim some of it. There was the park at Brixham, where I tried to take the park entrance with me when I drove through the gates; and a drive to Monaco when at the last minute for some reason we could not take the van full of tackle and fireworks across the ferry to France. Hurriedly we had to remove the fireworks, which were all packed in tea chests, as was the custom in those days. The fireworks were flown across to Le Touquet, where we had to drive the van and collect them. Many of the shells were round in those days with the lift in cones, which were not too secure. The airport men said that they had found “tea” leaking from the chests on the floor of the plane. Now the chests were on the back of the van and were bounced all the way to Monaco. What a mess! We repaired as best we could, and the cones were replaced with gunpowder and tea mixed together. Old tea chests always had loose tea in them, but we also found some Greek shells in a store and used the lifting charges in them and hoped for the best.

Nearer home in Kimbolton, Pains had been asked to put on a four-yearly display at a nearby town that had been founded by Quakers as a garden town. As it is quite near to us, we still do this display, which has just had its centenary. On this occasion it was a dank, still night when the smoke and humidity hung everywhere. In those days the old manufacturers used huge posts 100 cm square and 6 meters high. On the top of one such post was a large horizontal wheel, but when the match was ignited, nothing happened. The operator went back, but there was no ignition. As we watched, we could see the fire creeping so slowly up the match pipe. I was amazed to see the operator, portfire in his teeth, climb up the post like a monkey and light the piece at the top. He was not young either and had originally worked for C. T. Brock.

San Sebastian–1968 was the time when I was to meet a lifelong firework friend, Dr. Felix Göni, at that time a medical student and now professor of biochemistry at Bilbao University. Long associated with the Valencia firework trade, Felix has been associated with fireworks most of his life. Recently, discussing the problems that EEC bureaucracy is causing for the industry, he characteristically said, “All those years ago we thought that pyrotechnics was all about fireworks.”

It also was about this time that we were starting to require some working income at Kimbolton Fireworks, and this led to our acquiring a big display in the center of Oxford for the Round Table at November time; it has continued to this day without a break.

A problem with November displays tends to be the requirement to have the traditional bonfire. At Oxford they used to have two, which were either side of the viewing area. After some time we persuaded them not to have the fires until after the show. It is not so much the light that spoils the fireworks, although this is bad enough, but the light shows just how much smoke is created by the display. It not only conceals the firework effects, but also destroys anything with weak light emissions such as charcoal gold effects. At one of the early displays, I have often wondered which caused the most fun because shortly after the show had started, the wind blew sparks into the fires, which were well primed with flammable oils and I got hotter and hotter. Gradually I stripped off many of my clothes while the crowd produced a tune we all tend to associate with this kind of entertainment.

Around this time we shall never forget a display in Brighton, where we found to our surprise that we had only about 100 centimeters of soil on top of solid chalk. The stakes would not go in the ground, and it was the first time that we had taken a Crown Wheel (Girandola) as we thought that we had perfected this. Most people know that you need only one erratic motor for the device to go off course, and ours did. It lifted about 4 meters, turned 90 degrees, and moved toward the crowd. It is an unnerving experience as you realize what might happen and you cannot run after it and get it back. As it reached the crowd, but becoming lighter, it just lifted over their heads and headed for a huge marquee full of people and drink. People were running in all directions and the mood changed again. Happily, it burned out in time and fell to the ground, but we were besieged by people who said "What a wonderful firework! How did you make it do that?"

I had met the Wells brothers (Joseph, Albert, and Wilfred) long before 1972. They were well respected in the industry, kindly, honest, old-fashioned as you might say in the nicest possible way. Things were not going well and they were elderly by then. The factory had moved from Honor Oak Park to Dartford marshes about 1940, but it was the dramatic flooding of the Thames in 1953 that crippled them. With magazines crammed full for the coronation, they lost almost everything and one magazine created much devastation when it blew up as it dried out. We have often speculated that it would be ammonium perchlorate, barium chlorate, potassium chlorate, and seawater. By 1965 they had 120

employees, but it was never easy and they sold out to Schermuly in 1968. Ian Craig from Schermuly became the manager until 1971, when it was decided to stop making fireworks. Ian carried on the business from then onwards as a display organization called Phoenix Fireworks. The time was also significant to Kimbolton, who took on a small number of their shows—Henley Regatta, Aldeburgh, and Thorpeness, which we also still do in 2005.

Pains-Wessex took over Schermuly in 1971, and then Unwins became involved and the factory was closed in 1984.

The three displays among the others that the Wells brothers had kindly passed on to us have their own distinctions to this day. Henley is, of course, one of the great social occasions in the United Kingdom. The events culminate on the first Saturday in July with great pomp and a splendid display, which we have always been proud to execute. Aldeburgh Carnival is a lovely event at the seaside in a small town, but the display takes place on the shingle beach. It is easy to drive the posts in the shingle, but walking to and fro for a night to set up just about cripples the calves of your legs. Thorpeness has its display on an island in a mere, which is just a flooded river and not very deep. The children create a water pageant in the summer, which culminates in this display. When we first took it on in 1972, we found that Wells had sunk great posts in the mere using barges, but we persuaded the client to go aerial. As the island is small and a haven for ducks, we used to park a barge at the edge and fire the large rockets from frames on the barge. On one occasion when my wife was the assistant, she had a bit of an accident stepping back from the barge to the island, the ducks had characteristically greased the land, and Kath's foot went into the water between the barge and the island. It was a double drama because the trees and bushes on the island were useful for natural functions but, to my wife's horror, they had all been cut down that year.

Clacton Carnival was another Wells display, and when we first arrived the groundsman proudly showed us his collection of 6-m by 100-cm posts and two rugby posts for the waterfall. As we needed little of it for an aerial show, he was clearly worried, but they were happy with the change and simpler set piece arrangements—we had adopted aluminum scaffolding to save weight. However, the organizers had a temporary enclosure at that time to collect revenue, and one cheeky youth who had climbed up it refused to get off. When we fired the first maroon, he was scared, fell off, and broke his arm.

Another interesting annual display from Wells was at a naval training establishment for boys called HMS Ganges. The display took place

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