

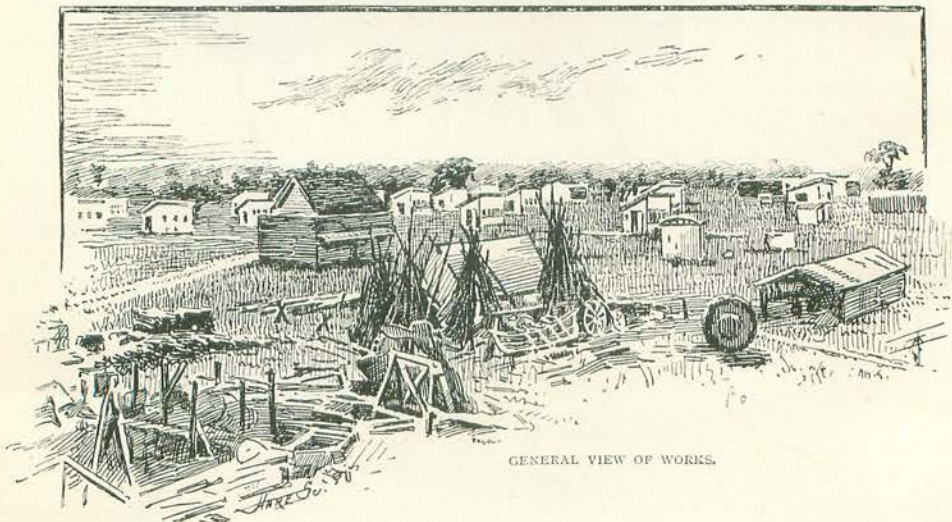


THE manu-
 facture of
 fireworks
 has really
 become a
 fine art, and to
 spend a day at a
 factory throws
 considerable
 light as to how

preparations are made in order to keep green the memory of a certain enterprising individual whose name is inseparable from the 5th of November. Imagine a great green field of fifty acres, with a hundred small outhouses dotted about here and there, and countless tram lines in miniature, over which firework trucks run—such is the first idea of Messrs. C. T. Brock & Co.'s factory at South Norwood, the largest in the world.

It will be as well to take shed by shed, and follow the making of the squib, cracker, Catherine-wheel, or set piece from start to finish. The paper is the first consideration. Here is the store. There are thirty tons inside now, and a season's manufacture involves the using of some 300 tons. It costs from £7 a ton for the brown to £50 a ton for the best white, and this little load helps to make twelve million farthing, halfpenny, and penny goods a year. The wet rolling shed is a square building with two great stoves in the centre, which are connected with huge racks above containing 50,000 cases. In the winter months the fires are lit, and the cases go through a process of drying. Just at the present moment some 10,000 rocket cases are suspended from the roof, intended for Trinity House work.

It is interesting to watch the men at



GENERAL VIEW OF WORKS.

work. A good hand can roll a gross of cases a day—a boy industriously pasting the paper, which at the same time he energetically rolls. Here, too, the shells are made—great explosive balls which vary in diameter from three and a half inches to twenty-five inches. These are used for large Government displays and State occasions. The biggest of these will turn the scale at two and a quarter hundredweights, and when it bursts its *débris* covers a radius of a quarter of a mile from the bursting point. It costs £50

left for the fuse, and then the two separate pieces are joined into the round with glue. Look in at the dry rolling shed, where a little army of young women are busy making coloured lights. They sit at slate tables, with paste-pot and brush handy, and piles of paper in front of them cut to a square about the size sufficient to hold half-an-ounce of tobacco. The thin rolls of paper are shaped with a steel rod, and are used for the great set pieces. A girl can roll twenty gross of cases for coloured lights in a day. In a corner of



WET ROLLING SHED.

to fire one. Such a huge shell, however, has only been exploded on two occasions, both of which were at Lisbon—the first in 1886, when the Crown Prince of Portugal was married, and again on the visit of the King and Queen of Sweden to the Portuguese capital in 1888. The 1886 display cost £3,500, and the fireworks were let off on the River Tagus, when thirteen men-of-war, troopships, and hulks were called into service. The second display cost £5,000, and these are the two most expensive on record.

Shells are made in a mould of plaster of Paris or metal. The two halves are manufactured separately, with forty or fifty layers of brown paper for a medium-sized shell, securely pasted together. A hole is

this room is a good lady who has made fire balloons for the last twenty years. She can turn out three a day, and when it is remembered that a fire-balloon stands 14 ft. high, has a capacity for holding 400 ft. of gas, and that no fewer than 112 pieces of paper take part in its construction, we are inclined to single her out as a very champion of balloon-makers.

The store-rooms of the Japanese lanterns form an interesting building. Fifty thousand lanterns are imported from Japan every year, at prices ranging from a farthing to ten shillings each. At the present moment 25,000 are stored away in immense bins—total darkness is necessary so as to retain the colour—and we are assured by our guide that every one



DRY ROLLING SHED.

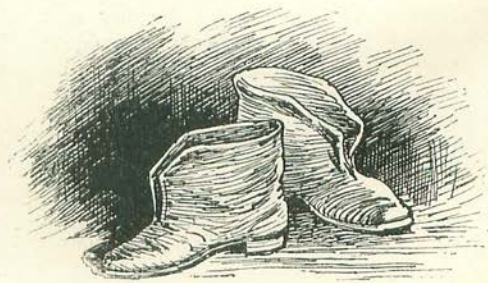
of the 25,000 is of a distinctly different pattern!

The iron house which holds the charcoal must not be forgotten. The charcoal is stowed away in sacks very much resembling soot bags, and fifty tons are used every year. Charcoal, indeed, is one of the principal ingredients of the common firework—the farthing and halfpenny goods. The cheap squib or cracker, which the youth of the town delight to let off at our heels, is principally composed of saltpetre, sulphur, and charcoal. Only about twenty tons of gunpowder is necessary for a year's manufacture, and this is only needed to lift shells or to make a noise. The better class of fireworks, known in the trade as coloured fireworks, are for the most part made of chlorate of potash, shellac, and a proportion of mineral salts to give the requisite colour.

As we hasten across the field to the secluded houses where the filling takes place we do not fail to take note of a huge cauldron near an immense boiler. The cauldron in question is the paste-mixing pot, and it will take a sack of flour to fill it. The water is poured in and then steam is turned on at something like 30 lb. pressure. You could count in another building 150,000 fairy lamps of every colour of the rainbow—violet, blue, white, green, yellow, plum, and ruby. The ruby glass—the most expensive—is made in Bohemia, and

the other colours in France. When they return from giving a fairy-like appearance to the trees and paths, they are washed in pans capable of holding 150 at a time. Alas! many of these fairy lights which leave the place are destined never to return. 5,000 have been broken at a single display, and at a recent flower show at Newcastle-on-Tyne, when everything was swept away, some 6,000 little lamps were carried away by the windy weather. Just a little arithmetical calculation in the carpenters' shop, where the strips of wood are cut from the great planks which lie scattered about the place, for rockets, reveals the fact that close upon a million strips are here, and 300 ropes of nine feet length, used for putting up set pieces.

We have now reached the little houses where the firework cases are filled, and for the first time we realise the great precau-



SAFETY BOOTS.

tions taken in order to ensure perfect safety to the workers. All persons working in the factory are searched on entering. They must also wear woollen jackets from which the pockets are cut out and sewn up. They then go to their respective sheds, and put on a pair of huge over-all safety boots of brown leather of quite a fashionable colour, without any nails.

The houses in which they work have much that is interesting about them. They are wooden buildings about 16 ft. long by 12 ft. wide, and of a proportionate height. Small gas jets are placed outside the windows to provide light when working in the winter.

The floor is covered with linoleum or lead, and the interiors are scrupulously clean. When it is mentioned that a Government inspector has fined the firework manufacturer for allowing a cobweb to be seen in one of these little houses, it will be understood how clean these places are, and how totally free from grit or dust. All girls who make fireworks, and who are responsible for the cleanliness of their dwellings, should make capital housewives. Every one of these sheds is licensed for the different operations which are carried on inside.

The number of people and the amount of explosive matter allowed in the building during the operation of filling are set forth on little black boards placed outside near the door. We quote the contents of one of these boards in order that it may be more readily understood.

A. Filling and charging. Fireworks 50 lbs.

Composition 25 lbs.

Number of persons, 4.

Or—

B. Finishing. Fireworks 100 lbs.

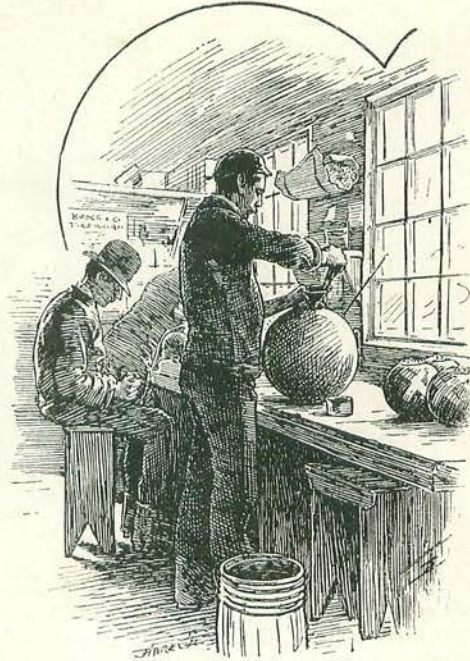
Composition 5 lbs.

Number of persons, 6.

Or—

C. Packing. Fireworks manufactured or completed 1,000 lbs.

Number of persons, 4.



CHARGING SHELLS.

Of course, these rules vary in some of the sheds, according to the character of work which is carried on within.

In one particular instance the work has to be so minutely done that only 30 lbs. of composition for fireworks is allowed in at one time, and only one person permitted to be inside.

At the door of these buildings pails filled to the brim with water are placed in a handy position, and the working sheds are 25 yards apart, and the magazines from 25 to 75 yards apart.

We now peep into some of these firework houses; having put on our boots in order that we may abide by the rules, we enter and watch their tenants at work.

In one shed they are charging rock-



CHARGING HEAVY ROCKETS.



MAKING CRACKERS.

ets, in another heavy Government shells. The composition with which the firework is charged is first mixed in one shed, and brought along in a barrel carefully covered up.

The workers sit before three small receptacles containing the different coloured compositions needed. One man has a small block, on which is placed the case to be filled. He rams the composition into a case with a heavy wooden rod, and then gives it a strong tap with a box-wood mallet to make the ingredients tight. It is then placed on one side ready to have the finishing touch put to it.

The services of young girls are mostly called in-to requisition for the making of crackers and Catherine wheels. In the trade the manufacture of a cracker is considered the most simple of any class of fireworks. Little paper cylinders about the same size as the stem of a tobacco pipe are filled with fine-grain gunpowder, which is then run through a press.

A girl then bends the flattened paper cylinder in a zigzag fashion, it is passed on to another worker who ties it together, and finally a little piece of blue paper is placed on the tip, and the cracker is completed.

Here they are making the halfpenny Catherine wheels. This, too, is a very simple process. The paper is taken in hand, in the top of which is placed a funnel. The composition is poured in, and, as fast as they are filled, away they go to another shed to be wound round a wooden disc and fastened by sealing-wax.

A blue paper band pasted round the article brings about its completion.

The manufacture of a Roman candle is, perhaps, a trifle more elaborate. Those glorious coloured stars which suddenly burst out upon us are little square pieces of composition. When a worker has taken a Roman candle case in hand he first puts a layer of powder in, then a coloured ball, or rather, square, followed by a fuse for slow burning until another layer of powder comes, and another ball, and so on to the end. The requisite amount of powder needed to throw these balls many feet into the air is infinitesimally small—just a tiny



MAKING CATHERINE WHEELS.

scoop full, or as much as would cover a threepenny-piece.

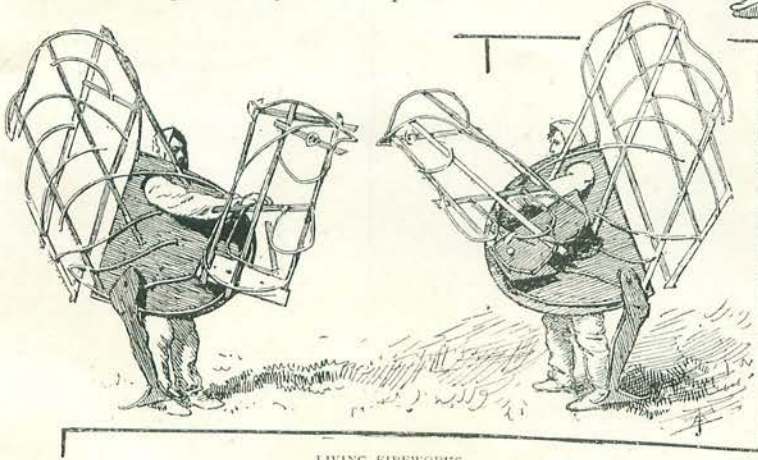
You can look into another shed, where they are filling the shells, many of which have thirty different colours and effects in them. Turning away from the sheds and the workers therein, we return to a huge house where the set pieces are made. Those who have seen the great display at the Crystal Palace and other places of entertainment, cannot fail to be interested in knowing something of the process by which these immense set pieces are made. We hear some startling statistics as to the cost of a Crystal Palace display, which is about £10 a minute. Such a display as that given when the Queen was proclaimed Empress of India at Delhi cost £3,000.

The furthest spot which Messrs. Brock & Co. have visited for the purpose of letting off fireworks was to India, in 1875, on the occasion of the visit of the Prince of Wales, when hundreds of tons of fireworks accompanied him for the displays there.

No fewer than ten displays were given, at costs ranging from £1,000 to £2,500 each. During the recent Jubilee £250,000 was spent in fireworks, and it is estimated that the amount of money spent on fireworks every 5th of November falls little short of £100,000. To make a set piece depicting "The Battle of the Nile," which is over an eighth of a mile long, takes 400 gross of little coloured lights and 7 miles of quick-

time in this country was 5,000, though on the Continent they think nothing of providing a display of 10,000 as a bouquet of rockets. This is always considered the most important feature of a display.

Supposing one wanted to make a set piece—a portrait of the Queen, for instance. The first thing to do would be to make an outline drawing. This is then divided off into small squares to a set scale. A huge frame of laths is then needed, which is divided up into convenient squares, some 10 ft. by 5 ft., to work on. The whole thing is then laid down on a level floor. The worker takes the drawing and follows out over the frame the features, &c., in chalk, so as to ensure getting a true design. Then a small gang of lads come along with canes for curves and thin laths for the straight parts. The whole of the head, with the crown of Her



LIVING FIREWORKS.

Majesty, is now ready to be pegged—that is, little pegs are driven in at intervals of three inches along the design, and this having been done it is carried away to the place of exhibition. A body of men repair to the spot where Her Majesty is to be seen in fireworks, tak-

ing with them sufficient lances or coloured lights to illumine the head. These are put on, and at the right moment the whole thing is lit up.

Perhaps the greatest curiosity of recent years in the way of firework displays, has

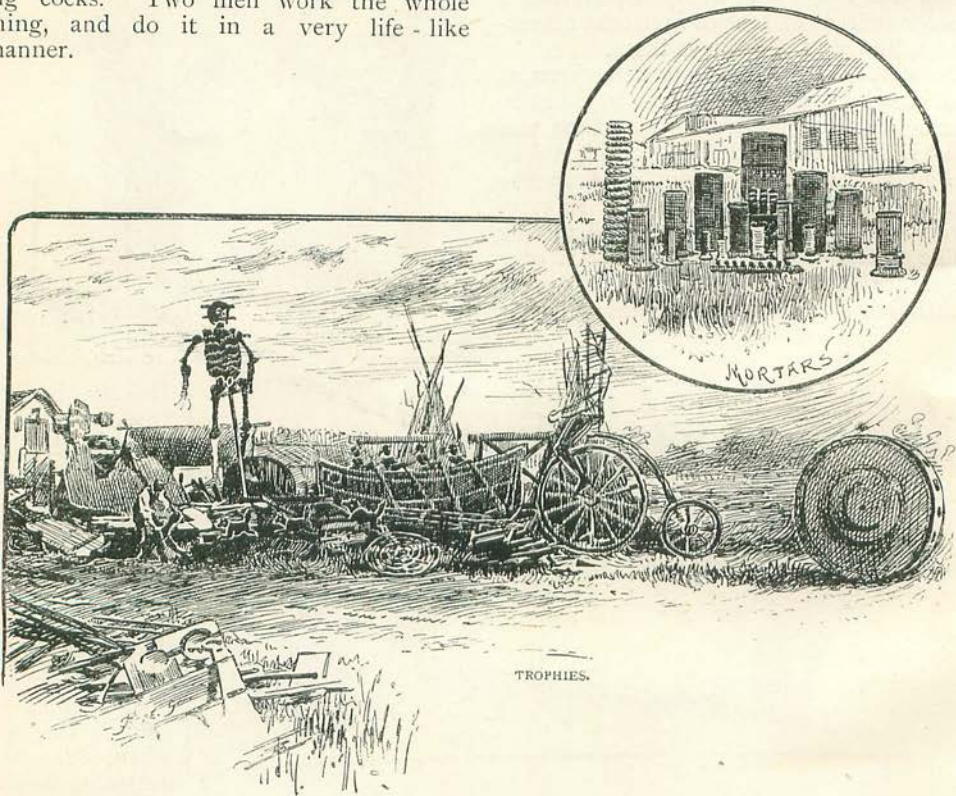
match, to say nothing of half a hundred-weight of pins to fasten the various parts together.

One learns, too, that the biggest Catherine wheel ever made was 100 ft. in diameter, and the biggest display of rockets at one

been centred round the living fireworks. The "fighting cocks" greatly amused the Shah when he was over here, and the "boxing men" caused unbounded delight to the Emperor of Germany. However, whilst we were going over the premises the whole secret as to how they were worked leaked out. They are indeed living fireworks. Take the boxers, for instance. They are really two men clothed with an "asbestos" suit, and entirely protected from danger, who have fastened to one side of them a framework of fireworks, depicting a man in fighting attitude. The whole thing is lit up, and the brilliancy of it prevents the man behind being seen. He boxes away with his opponent, raising his hand, and dodging his head, and as he does so the frame on which the fireworks are fizzing necessarily does the same.

It is precisely the same with the "fighting cocks." Two men work the whole thing, and do it in a very life-like manner.

There are numerous bygone trophies of fireworks to be seen about the place. Here is a skeleton out of which every spark of life has vanished, the remains of a giant. Alas! but a sorry sight of what his immense statue once must have been. Only a few strips of charred wood remain. Here are broken bicycles, shattered boats and sledges, and here in a corner are the original mortars used in Hyde-park in the great display which took place to celebrate the triumphant conclusion of the Crimean War. Mortars marked "Calcutta," "Bombay," "Delhi," reminiscences of the Prince of Wales' visit to the Empire, and just close at hand is a curious Japanese mortar made of bamboo, riveted together with wood, and wound round with cane rope.



TROPHIES.