

a pantomime, as airy and light and fragile as the lace and flowers which floated about her, and with a joy and brightness that transcended any joy or radiance cast by footlights in her face. She knew nothing of the troubled night the others had spent.

Now the hour was at hand, and the carriage waiting. It was time. With pride the captain led down his treasure.

"He is a noble fellow," he said to her. "Even something I have heard to-day of him. You will be very happy, my child."

"Ah, the little secret! He has told you that—"

"No, no," said uncle Diamond, gravely; "something else, and not nearly so trifling as that."

"Then I shall make it out myself. It will be an amusement," she said, gaily.

"Hush! my child," said the captain, looking round in alarm. "On no account—not by any means. Take old Tom's advice. Keep the closet door shut, my pet, and start a new life."

"But Martha says I ought to know, and—"

"Martha says more than her prayers, dear. Ah! here's the church." And the captain settled his flowers and moved up the curls of his wig.

Then the old ceremony was repeated in a not very cheerful church, which, from all the oak partitioning, had the air of a large banqueting-hall; and, at a very highly-polished balustrade that shut in the clergyman carefully, the ceremony was "performed impressively," as every ceremony of the sort luckily is, and Mr. Tillotson was married. There were no graven images about the place—not so much as a patch of glowing stained glass which could have furnished a sacred picture or memorial. All was rigid, cold, and barren. (The church was, in fact, decaying fast.) But Mr. Tillotson's eyes were lifted up to the roof, where they seemed to seek the direction of something that was holy, and he repeated his declaration with fervent lips that, with help from above, he would never let his soul stray back to the past, and do his utmost, even if the struggle cost him his life, to be loyal in heart, soul, mind, and truth, to the young maiden who now stood beside him as his wife.

END OF BOOK THE SECOND.

SMALL ARMS.

ENFIELD and Enfield Chase, Enfield Wash and Enfield Highway, Enfield Station and Enfield Lock, form rather a numerous family, very much scattered, and so little warlike in appearance, that one marvels how the government manufactory of small arms (rifles, pistols, and so forth) came to be pitched in such a district. Enfield Lock, where this fine establishment is situated, is a veritable end of the world in one respect; for it butts up against the river Lea, on the other side of which are the uninhabited and nearly

uninhabitable Essex marshes. Some years ago there was a small establishment here, a kind of satellite to the government powder-works at Waltham Abbey; and when it was resolved that John Bull should make his own rifles in his own workshop, this satellite was raised to the dignity of a superior planet.

There is a tolerably pleasant road from the railway to the works, bare of people and of houses at first, but becoming more bustling as we advance. We meet with rows of houses which have been constructed for the work-people by speculative builders, and others built by the government on government ground. The hostleries of the Ordnance Arms and the Small Arms Hotel have a smell of gunpowder about their names. There is a Mechanics' Institute, and there is a dining-hall; and it is in this hall, if we remember rightly, that a military ball was held last autumn. There are shops in which the multifarious wants of workmen's families can be supplied; and there is a sort of impromptu market-place, where—especially at pay-hour on Saturdays—itinerant dealers in all sorts of comestibles assemble in great force, to the immense delight of the children. At that pay-hour of which we speak, a clerk can pay a thousand men or more in less than half an hour, each man having his packet of wages ready for him at the instant he passes an open window of the pay-office; and thus there is no loitering about at public-houses, wasting time and muddling with drink. At one o'clock there may be, say, sixteen hundred men and boys with pockets nearly empty; at a few minutes after one there may be sixteen hundred pockets containing money for the week's services. The men wend home with their money, some to the neighbouring rows of houses, some to Waltham or Enfield town, some to Edmonton or Ponder's End, some elsewhere. The impromptu market-place outside the works, and the pay-office inside the works, are near each other—a deep bit of philosophy on the part of the itinerant market-people. Crossing a bridge commanded by a superb policeman, the representative of royalty, we enter a remarkably clean-looking central quadrangle, having a canal-basin to accommodate barges which bring stores by means of the Lea navigation; and on all sides of this quadrangle are well-constructed and well-kept buildings. Most of the doors have numbers painted on them, to denote particular shops and stores, and to facilitate the strict system of management observed throughout the establishment. Colonel Dixon and his trusty staff could almost trace the biography of every bit of wood and iron brought into the place, until it finally departs as a component part of an Enfield rifle.

What a wonderful trade this is of murderous weapons! Birmingham is the workshop of England for muskets, whether rifled or smooth-bore; and there is no reason to expect that the leadership will be taken from her. During the great war against Napoleon, the number of muskets made was almost incredible. Between eighteen hundred and four and the end of the

great war, Birmingham made three million muskets for the government, besides one million for the East India Company—something like a thousand muskets every day for twelve years. In the busiest of these years the product was *a musket a minute!* All the barrels were made at Birmingham; but some of the muskets were made up in London and other places. During the recent struggle in America, the gun-trade at Birmingham underwent many singular fluctuations. As soon as the United States had determined to wage resolute war with the Confederates, three or four persons appeared at Birmingham on one day, all, unknown to each other, bent on purchasing arms for America, either for the government or for speculators; between them they cleared out the existing stock, and gave orders for more. When the troubles about the Trent affair commenced, an embargo was placed on the export of arms from England; but when the clearing up of difficulties allowed the embargo to be removed, Birmingham set to work more vigorously than ever. Whether "Feds" or "Confeds," it was all one to her; she sold muskets to whomsoever wanted them, and would pay for them. No less than forty thousand muskets were shipped off by one steamer from Southampton. During part of the time, Birmingham worked faster than at any former period in her history, making and proving two thousand barrels per day. From first to last, from the firing of the first shot at Fort Sumter to the surrender of Lee's army, England sent more than a million of muskets to America, two-thirds of which came from Birmingham. At the present day there are six hundred gun-manufacturers in this town, great and small, or, at least, makers of the various parts of guns, employing more than seven thousand hands. According to Mr. Goodman, who read a paper on this subject at the last meeting of the British Association, there are seven hundred making gun-barrels, twelve hundred making gunlocks, five hundred making bayonets, one thousand making and fitting the wooden stocks, one thousand screwing up or putting the muskets together, one thousand finishing the arms when made up, and nearly two thousand engaged in various subsidiary employments. A mighty army this, all engaged in making weapons intended to slaughter either men or birds. No wonder that Birmingham could take the principal part in making the six million small arms which England has turned out in six years.

The beautiful establishment at Enfield would in all probability not have existed had "Brown Bess" continued to reign. The extreme accuracy requisite for a rifled musket, as compared with a smooth-bore, entailed a necessity for improved tools and machines; and these improvements offered a temptation for the founding of a government establishment. The theory of a rifled barrel, to give accuracy of flight to the bullet, is some centuries old; but it was not till modern times that new forms of bullet to fill the rifled grooves were successfully devised. There was Sir Home Popham's elongated spherocylindrical

bullet; and Captain Beaufoy's elongated bullet, with a hemispherical cavity at the end; and Joseph Manton's bullet, with a wooden cup at the end; and Captain Delvigne's expanded chamber behind the bullet; and Mr. Greener's expanding bullet; and Mr. Pritchett's cylindrical plug; and Captain Minié's furrowed bullet; and Mr. Lancaster's oval bore; and Mr. Whitworth's hexagonal bore: these and numerous others were various modes of rendering the spiral grooves of a rifle more efficacious. What is called the long Enfield was not the invention of any one person; it was a kind of eclectic combination of good qualities from various quarters. And the same may be said of the short Enfield more recently introduced. Minié liked a bore rather under three-quarters of an inch; Mr. Whitworth, one less than half an inch; while the Enfield has settled down to a calibre just about half way between the two.

Enfield, we have said, owes its beautiful factory mainly to the introduction of machinery into the gun trade. This resulted from a visit, directed by the government, made by Mr. Anderson and Mr. Whitworth to the New York Industrial Exhibition. These two eminent engineers examined the machines invented by Colonel Colt, Mr. Blanshard, and others, for making rifles and pistols in America; and the superior accuracy, rapidity, and cheapness of the system, attracted the attention of our government. Mr. Anderson, visiting Birmingham after his return from America, commented on the harum-scarum way in which the hand method was conducted. "In visiting Birmingham, any stranger must be much struck with the number of persons, men and women, boys and girls, that he meets in the streets, carrying parts of muskets on their shoulders and in other ways, and with the great waste that necessarily goes on under such an arrangement, carrying the parts from one place to another. Of course the wages that are thus paid come into the price of the gun. I am quite sure that if we had a map of Birmingham, with all the walks through the highways and byways of the town that the several parts of a musket have to travel, it would do far more than anything I could say to advocate the proposed plan—to have everything connected with the musket passing consecutively from one stage to another, never passing over the same ground twice. The rude materials, entering the factory at one end, should come out a finished musket at the other."

And so it was decided that the Enfield Small Arms Factory should be established, partly from the necessity of furnishing the army with rifles instead of smooth bores, and partly for the purpose of introducing machinery into this very elaborate branch of manufacture. Selecting the small works already existing, making firm foundations in the marshy ground, building large and fine workshops and engine-houses on the ground, and stocking them with some of the finest machinery ever seen in this country, the government have spent on this spot something like two hundred thousand pounds in the last twelve

years. The place is a kind of cosmopolis. No one patent, no one manufacturer, is favoured in particular: any machine is accepted from anywhere, provided it will render the required amount of service.

There are few things more marvellous in mechanical art than the shaping of the various parts of an Enfield rifle by machinery. Take the stock, for instance. Walnut-wood is imported from Italy, and is roughly sawn into pieces approximately resembling the stock, with a broad part at one end for the butt. These pieces are placed in a series of machines, one after another; they are made to rotate rapidly, and self-acting cutting-tools shape them with wonderful quickness and accuracy. The curvatures of the stock, as every one knows, are very varying and intricate, yet they are all effected by the machines; and so are the sockets and recesses which receive the barrel, the ramrod, the bayonet, the lock, the plates, the screws, the sight. It follows, too, from the unerring accuracy of the machines, that every stock is exactly like every other, insomuch that a lock or a barrel that will fit any of them will fit all.

Look at the lock again. Pieces of white-hot steel are stamped, punched, and swaged in such a way as to assume the rough forms of the several pieces of a rifle-lock; and then each piece is brought under the action of exquisite machines, which, passing in succession over every minute hundredth or thousandth of an inch of surface, give the proper size, shape, and polish to everything. Then the barrel. Pieces of the finest iron that can be made, called skelps, are brought to the factory. Each skelp, about thirteen inches by five, and rather more than half an inch thick, is heated in a forge, passed between rollers, bent round to a cylinder, heated again, elongated by drawing, and made into a rough sort of barrel. This barrel is turned or bored on the inside, and turned on the outside. Woe betide the barrel-borer who thinks a thousandth of an inch an insignificant trifle! If he deviates more than this minute quantity from the formula, "nought decimal five seven eight," he loses his labour, and is perhaps fined in the bargain. The barrel-inspector is a keen-eyed man; nothing escapes him; he is provided with steel plugs or gauges, some of which must, while others must not, pass through the finished barrel; and then, by looking through the barrel at a window, he can detect the smallest irregularity in the interior. If it is the long Enfield that is being made, the barrel must be three feet and a quarter long, must have three spiral grooves three-sixteenths of an inch in width, and the spiral must make just half a turn in the whole length. If it is the short Enfield, to carry a sword-bayonet, some of these numbers undergo modification. If it is the Whitworth rifle, the six grooves must twist round much more sharply than in the Enfield.

The putting together affords a proof of the wonderful accuracy with which all the separate parts are shaped. There are sixty or seventy pieces altogether in an Enfield army rifle, in-

cluding screws, which have required several hundred distinct and successive processes to form; these are reduced to about twenty, by joining some of the smaller pieces together; and the twenty are handed to the screwer-up or putter-together. Fastening a stock in a vice, he takes a barrel from one heap, a lock from another, a butt-plate from another, a belt-swivel from another, a bayonet-ring from another, and so forth; and in *four minutes* he builds up the complete rifle, all firm, smooth, and well fitted. There is no niggling, chipping off a bit here and a bit there, to make them fit; everything is known beforehand to be correct to a hundredth of an inch, and in some instances to a thousandth.

There is certainly much to be proud of in the place. One magnificent room contains several hundred machines, to effect the greater part of the shaping-operations; and we get a little amazed at the quantity of soap and water used to lubricate these machines while in action. Then there is the smithery, with its forest of cupola forge-fires, and its mechanism for forging, stamping, and otherwise shaping the various pieces of iron. There is the foundry, for casting such articles of brass, copper, or gun-metal as there may be in a rifle. There is the bayonet-shop, where the toughest of all steel is made into one of the most provoking of all weapons. There is the annealing and tempering-shop, where the metal is brought to a great nicety of hardness without brittleness. There is the grinding-room, with a stock of monster Derbyshire grindstones, which wear away under the ordeal to which they are exposed. There is the polishing-room, where the last finish is given to various parts of the rifle. There is the pattern and model department—the type and symbol of the wonderful precision which pertains to the several machines. These and many other rooms and shops give employment to a number of men varying from twelve hundred to two thousand, according to the briskness of the operations. With the exception of a few labourers, all are paid piece-work; and this gives a notable sharpness and energy to the men, since the amount of each one's earnings is intimately dependent on his steady application to the bench. Many of the men are in some sense small masters or contractors, taking more of a particular kind of work than they can do with their own hands, and paying others to help them. Enfield says that she can make government rifles cheaper than Birmingham.

Enfield is just now very busy preparing for a process of transformation. The grand battle of breech-loaders *versus* muzzle-loaders is, it appears, decided in favour of the former; and the government are about to see what can be done in utilising the rifled muskets already manufactured on the last-named principle. A year or two ago, the War Office invited gunmakers to submit plans for converting the Enfield rifle into a breech-loader. The conditions were, that the cost of alteration should not exceed one pound per rifle, and that the shooting-qualities should in no sense be impaired. The gunsmiths set to

work, and sent in no fewer than fifty different plans; or rather, gunsmiths and others, for this is a very favourite subject with many persons not immediately connected with the trade. The War Office entrusted the examination of these plans to the Ordnance Select Committee, by whom all were rejected except eight; and these eight were handed over to a sub-committee for detailed experiment. Five of these plans are breech-loading systems in which the charge is ignited by cap and nipple in the ordinary way, while the other three are adapted for cartridges carrying their own means of ignition. Each competitor was furnished with six Enfield rifles chosen by Colonel Dickson, and well tested for soundness and accuracy at five hundred yards' distance (greater distance seldom being wanted for troops of the line, whatever they may be for skirmishers and sharpshooters). The gunmakers set to work, and returned the rifles to the War Office, with a thousand rounds of such ammunition as each competitor might deem most useful.

To describe the metamorphosis which each Enfield rifle underwent would be the work of a gunmaker or an artillery officer; and to such persons only, indeed, would the description itself be intelligible. There is a good deal said about chambers, thimbles, rings, bolts, hammers, nipples, breech-stoppers, plungers, hooks, cases, wads, plugs, locks, levers, cylinders, pistons, hinges, and other delicate bits of apparatus, all belonging to the rear end of an Enfield rifle, when converted from a muzzle-loader to a breech-loader. In one system of transformation, nothing is left of the veritable Enfield but the stock; in another, the barrel is lengthened to admit the new apparatus; but in most of them the barrel is shortened two or three inches for this purpose. The sub-committee caused the altered rifles to be fired off a great number of times, in order to apply various tests to them. As concerns rapidity of firing, one and all beat the Enfield hollow, generally two to one, showing that breech-loading is better than muzzle-loading in this particular. They were next tried as to accuracy of flight, at a target five hundred yards off. The unchanged Enfield here beat its competitors, though all were wonderfully near the mark. When every one of the rifles had been fired two hundred and seventy times without cleaning, they were taken to pieces at Enfield. All the breech arrangements were sound; but some of the stocks told of hard wear, having been too much cut away in the converting. Then the rifles were pitted against each other for range, penetration, initial velocity, and recoil; or, rather, two rifles on each system having been compared in regard to rapidity, accuracy, and fouling, four more on each system were compared with reference to the other qualities just named. The penetration was measured by the number of half-inch elm boards, well wetted and placed in a frame half an inch apart, that a bullet could go through at thirty yards. These several experiments occupied many weeks of last spring to perform, and the results were tabulated

by the committee with the same care as a school inspector or competitive examiner tabulates his "marks." Thus, the rifle shots averaged about half a yard lateral deviation at five hundred yards, and four feet at eight hundred yards; one shot penetrated seventeen wetted elm planks; another took the lead in many of the conditions of general efficiency; while a third was the best of those which carry their own means of ignition in the charge (papier-mâché cartridge, with a brass cap at the base carrying the detonating compound, and lubricated for passing into the rifle with wax and tallow), and fired more rapidly than the others.

The upshot of all this is, that the machines at Enfield are, many of them, undergoing such alteration as will fit them for the manufacture of breech-loading rifles. There is a sort of interregnum in the place, King Muzzle having been dethroned in favour of another claimant to supremacy. It seems pretty well agreed that the Enfield rifle, for the general service of the army, is ultimately to be a breech-loader. May it pierce any imaginable number of elm planks, at any conceivable distance!

QUESTIONS TO THE CUCKOO.

I.

Was it not some lover
Taught you that one name
(Two syllables repeated
Year by year the same)?
Changeless bird, and faithful,
From the Afric sands
Once more come to greet us,
In these greener lands.

II.

Was it not magician
(Some dark wizard man)
Changed thee from a Pharaoh
By a talisman,
Till in English meadow
One should learn the spell
That would break the prison
Into which you fell?

III.

Pyramids, their builders,
Cuckoo, tell me now?
Zebra-bird so quaintly
Flitting bough to bough!
Did Jugurtha's horses
So outstrip the wind?
Tell me now the secret
Ishmael's race to bind.

IV.

Didst thou see when Carthage,
In a fire simoom,
Fell before the Roman
With his brow in gloom?
Wert thou in near palm-tree,
When proud Egypt's queen
Bared the fairest bosom
Eyes had ever seen,