

ENTRANCE TO THE SHELL FOUNDRY.

## THE ROYAL ARSENAL AT WOOLWICH.

BY CHARLES S. PELHAM-CLINTON.

**T**HERE are few more interesting sights than the Royal Woolwich arsenal, and yet it is surprising how comparatively few people have ever seen its wonders. Not that it is difficult of access or entrance, as frequent trains run within 100 yards of the front gate, and cards of admission can always be obtained from the War office. No one seems to have time to do anything except attend to social duties in London, and out of every 1000 you meet I would wager that not one per cent. has an idea of the work carried on, or the *modus operandi*. In a general way they know that guns and small arms are made there, and when the trial of a "Woolwich Infant" fills several columns of the papers they become aware that such things are made there, and that within an hour's run by train one of the most interesting sights in the world is to be seen. Then they forget all about it.

Woolwich arsenal cannot be "done" in a day. There is too much to see, and at least three days can be occupied in a thorough examination of those portions that are open to the public gaze.

Hardly any nation in the world lays its government factories and works more open to general inspection than the English; but even the British government has some secrets that must be kept and

to them there is no "open sesame." Only particular officials are allowed in, and these are men whose position and honor depend on their secrecy.

England has three ordnance factories, each of which is devoted to a different purpose, but the Royal arsenal is the most important, the others being the small-arms factories at Enfield and in Birmingham. All the powder is made at Waltham abbey in Essex, the kinds used being the SS. and black, and the gun cotton is also manufactured there.

The arsenal covers about 100 acres of ground in all, fronting on the river. Here the ammunition barges are filled and the guns shipped on special boats built for the purpose.

In all there is over twenty miles of railroad in the arsenal and thirty-nine locomotives are in full work all day long; in busy times these are not enough for the work to be done. The lines join all the different buildings, and the trucks or carriages, as the case may be, are hauled to or from the various stores and the wharfs which fringe the river bank.

The arsenal proper is divided in several departments, the most important of which are the royal laboratory, the gun-carriage department, the royal gun factory and the commissary-general stores. Besides these

there are half a dozen smaller departments, which will be mentioned in due course. All these, as well as those at Enfield and Waltham, are under one head, and a very important and onerous post it is. The system has been worked down so fine, however, that there is not the amount of detail work that might be expected, as competent officers are at the head of each and every department, and are responsible to the chief for what is done in their command.

The whole of the arsenal is surrounded by a high brick wall, and no one can pass in unless through the entrance gates, at which is always a squad of police. A stranger cannot pass without a special permit, but, this obtained, a guide is furnished him and he is allowed to look about where he wishes, excepting, of course, the certain hallowed precincts before mentioned.

Workmen employed in the arsenal are searched every night when they leave, behind a screen that is placed across the right hand archway, and the photographs and papers found on them are carefully looked at.

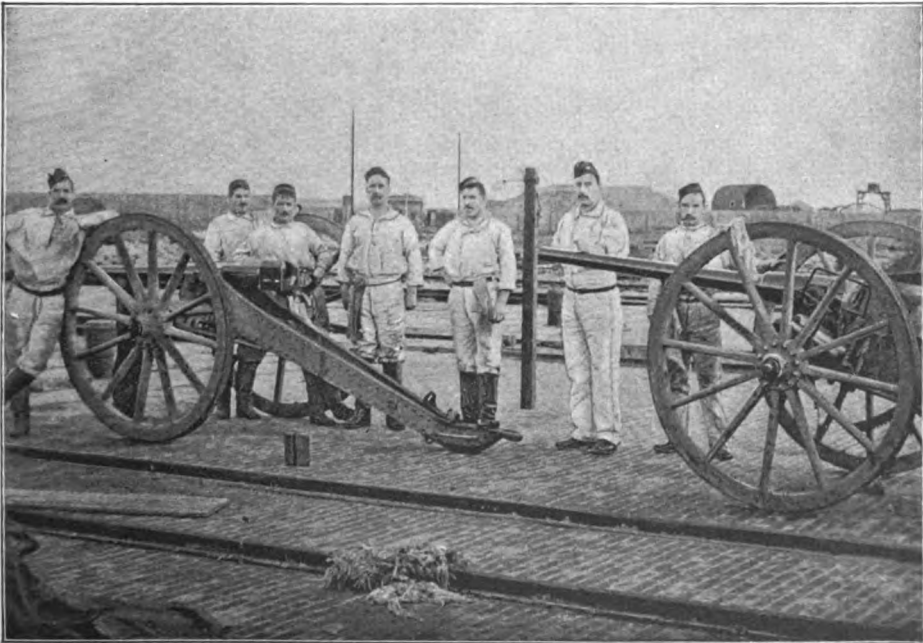
To the sergeant in charge of the police at the main entrance, through which, as I

said, everyone is obliged to pass, I presented my credentials. Having a personal letter to the director general from the War office, I was taken direct to his office and was given all the information I desired, and the guide was summoned.

In the office is a system of wires by which the director general can talk to persons in any of the hundred and more buildings in the arsenal.

Directly outside the director general's office is a very curious old Chinese gun that was taken from the Chinese during England's war with that nation. It is wonderfully chased and is well cast, though, of course, it is not rifled. Its length is very great in proportion to its other measurements, and the scenes and figures depicted must have taken an immense deal of time and labor to produce.

Guide Tracey, who had been detailed to show me all that could be seen, directed his footsteps to the main factory, which is a huge building and one in which hours could be spent profitably. It is 315 feet long and 200 feet wide, and the ceiling is a mass of revolving rods apparently so complicated that confusion seems unavoidable. To the wheels are attached the



TRYING SMALL GUNS AT THE BUTTS.

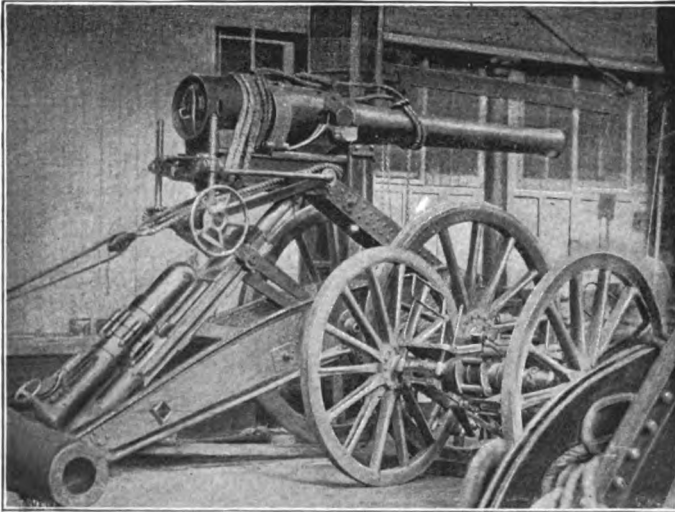
leather bands which revolve the lathes, of which there are over thirty in the building. These are used to turn the castings of the smaller shells, the brasswork of the rifle cartridges and to finish off the cartridges.

These, however, do not fill a fifth of the building. In one place are half a dozen machines cutting out caps for the Martini-Henry rifle, another half-dozen crimp the caps into shape, a like number cut the ends off, and then another machine, with almost human ingenuity, picks out those that are too large or too small and throws them aside.

The Martini-Henry shells are made much in the same way as the caps. They pass through the same number of machines, reaching the tester at last, which ruth-

lessly tosses them aside if not the right size. finished piece. One room is devoted to shells and the other to ammunition and torpedoes. An interesting thing is the rifle that the Prince of Wales used to fire the first shot at New Wimbledon. In another part of the building is a variety of life-saving apparatus that, beside the engines of death that surround them, have almost a ludicrous appearance.

The next move was to the carpenters' shops, and here thousands of feet of timber are being used every hour. All the boxes for the ammunition and shells are made by machinery, and here again everything is almost human. The men and boys seem simply to feed the machines with timber and the pieces come out dovetailed, squared and planed all ready to be put together, a new interpretation of the advertisement—You give us the plank, we do the rest. It takes about a minute to manufacture an ammunition box, and in a trice its parts are glued and put together and a truck takes it away to be dried, and afterward stamped with the "broad arrow" and painted, all of which is done in another part of the building.



MONCRIEFF CARRIAGE AND FAST-FIRING GUN.

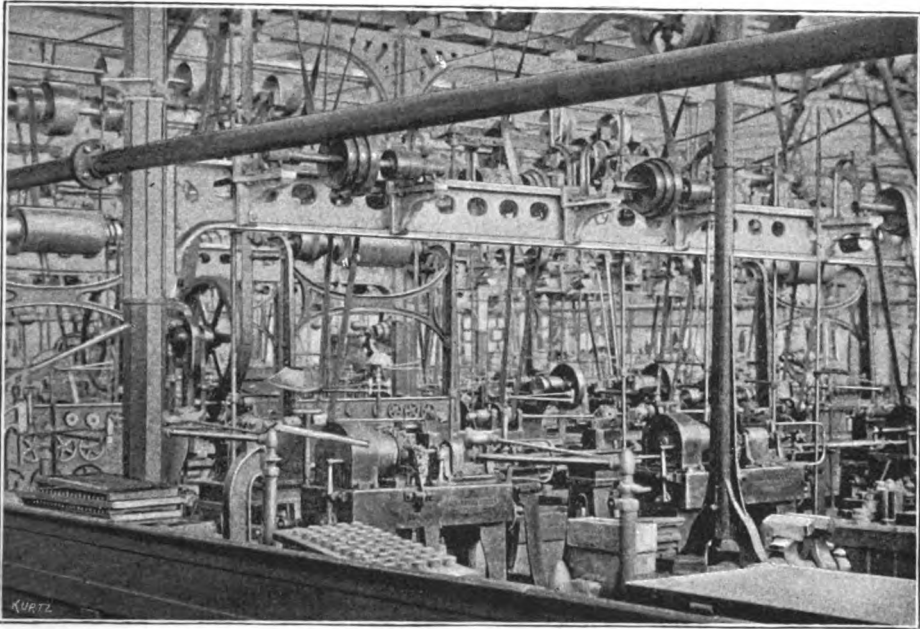
Another portion of the building is devoted to dynamite and also to the manufacture of the fast-firing Maxim gun cartridges and shells. It must be understood that the cartridges are not loaded here, that being done in the laboratory.

The model rooms are worthy of a longer inspection and description than space or time allows. Suffice it to say that every species of ammunition used by the English army is to be seen here, not only in the complete form but in its various stages, from the original rough material to the

shape and length, then iron bands, made in another part of the arsenal, are placed in an iron form somewhat the shape of a barrel. The staves are loosely fitted in, the bottom and top put in place, the cover goes on and in a trice a barrel is made. Hydraulic pressure forces the staves into their places, and as they and the bands have been made to a mechanical nicety everything fits perfectly.

In another portion of the room the bottoms and tops are cut out and planed, while in another the barrels get a coat of varnish and are marked.

In the roll mill the copper for the caps



INTERIOR OF THE MAIN FACTORY.

and the more solid cases for Martini-Henry cartridges and the yet larger cartridges for the big guns is rolled out in hundreds of sheets that are exactly the requisite thickness, and are carefully weighed before being sent over to the main factory.

Every stick of timber and every ounce of lead can be traced if necessary, the system of receipts being perfect, though involving a great deal of clerical labor.

I preferred to keep the most interesting portion, the ordnance factory, to the last, so Tracey took a turn to the north and we came to the shell foundry, the doors of which are handsomely decorated. Here all the huge shells are cast, and a very warm and interesting process it is. Every size, from the small ones to that which ten men could not lift, and the huge projectiles that are used in the big guns—one cannot call them cannon balls any longer as they are no longer made round—is being turned out in hundreds. If this activity goes on in times of peace, what Woolwich must be in times of war I can hardly conceive. Much of the material used in these castings has done similar service before. It is chiefly in trials and in practice that the ammunition is expended.

A very interesting sight is the yard wherein is stored all the "returned" can-

non balls—some that have come back from foreign stations, were sent out in the Crimea time, and now drift home again to be broken up and transformed into more modern engines of war.

Beyond this is the ordnance store department, where almost every necessary can be seen. Thousands of sets of harness, thousands of trace chains, shoes, spurs, saddles, every sort and kind of article that can be wanted is kept in stock, and the contractors and government factories stand ready at a day's notice to treble the supply when required. The spurs in one of the huge rooms were tastefully arranged in the form of the Prince of Wales' feathers, while in another bits and nails had been used to make the initials V.R. and the royal insignia above the initials.

The most perfect cleanliness pervaded the whole of these stores, and they seemed more like a private citizen's gallery of curiosities than the storehouse of a large portion of the requisites for England's great army.

As I said before, a great portion of the stores arrive and are despatched by water, and old Father Thames becomes very useful. The pier is solidly built and has a number of cranes, as heavy weights are the order of the day here. Away beyond

it are the butts where the huge guns as well as the smaller ones are tested, and where the trials of the Woolwich Infants have taken place.

Several lines of railway carry the guns to the required spot and they are fired from the carriages, the place being so arranged that the recoil sends them up an inclined plane. None of the big guns were in use when I was there, but squads of men were practising with a quick-firing gun, and Mr. Scannell, the photographer, took them in their working garments, to their intense satisfaction.

We then walked round to the wheel-house and the gun-carriage factory, where the artillery wagons and other gun carriages are made. These are stupendous works, and the wheelwright portion is a most interesting place to pass an hour.

Just about now, however, the whistles and bells began to sound for dinner and the hands knocked off for their midday meal; so, as for an hour nothing would be done, it was no use looking at the factory.

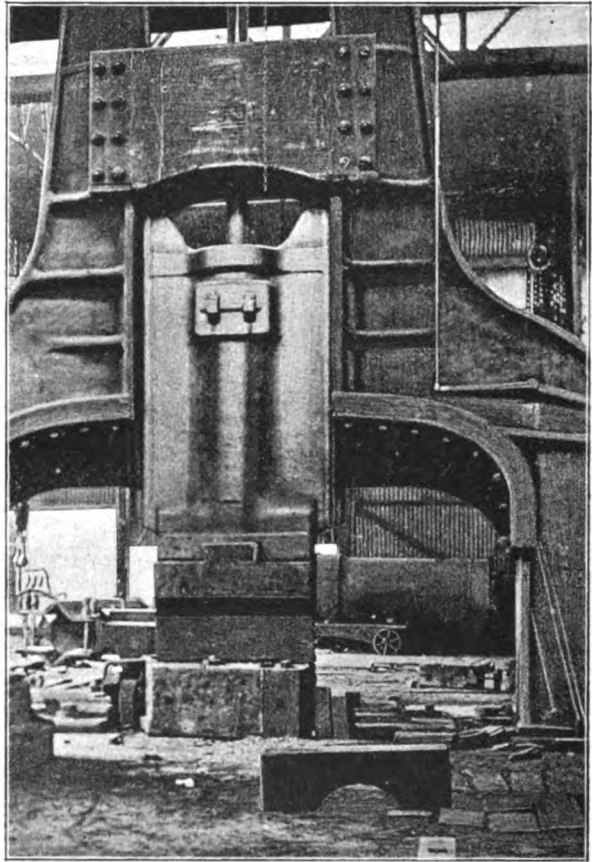
The hours are from six to eight o'clock in the morning, when the men stop work for an hour. At nine they commence again, to stop at one, commencing again at two o'clock and stopping work at five in the winter and six in the summer. The wages seem small compared with those given in this country, but they average from a pound to as much as five pounds a week, and there is constant employment for the best of the hands. They are certain of their pay, which seems a great thing to them, and the hours are not so long as if they worked for private firms.

In all 10,000 men and boys are employed in the arsenal, and while this number is sometimes exceeded in peace times it does not vary very much.

There are also schools for the children

and an excellent library, and both are much in request.

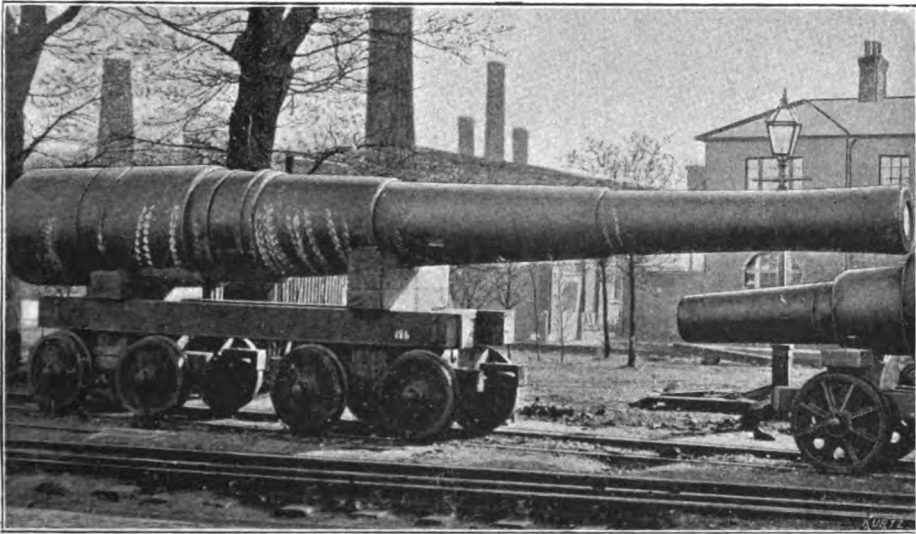
There is a fire department in the arsenal, in which the police act as the fire brigade, under Chief Inspector Cavil. Though sometimes there is a small fire there has never been enough damage done to amount to much, but the fire brigade is not allowed to become rusty, as it is called out for practice very frequently.



THE LARGE STEAM HAMMER.

There are guides provided for each department, though some of them are allowed to show visitors everywhere. Considering the number of men employed, the nature of the work done and the amount of machinery in constant motion, there are very few accidents, and these are usually caused by the carelessness of the employee.

A returning stream of men showed that two o'clock was nigh, and that we could have a look at the most interesting por-



A SIXTY-SEVEN TON GUN.

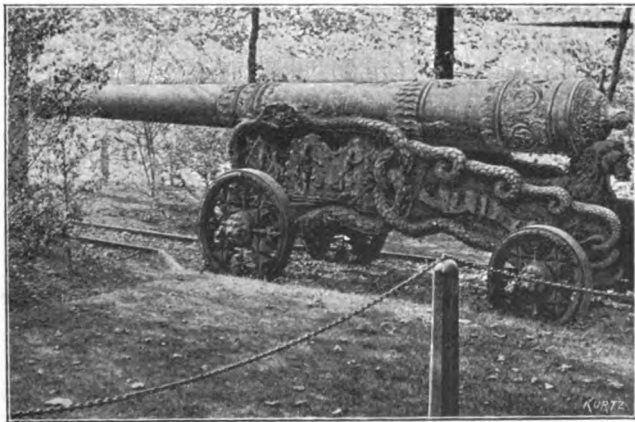
tion of the arsenal, the ordnance department.

Here was the kernel of the arsenal, the spot where the huge guns that have taken thousands of pounds to manufacture and thousands to test every year are made.

The gateway of the ordnance department is of white stone and is very massively built. It is flanked by old guns that have seen much service. Two went through the Crimea and show the marks of shot in several places. They are veterans who have earned peace and repose and will not be broken up. Inside are thousands of cannon of all sizes, shapes and sorts. Most of them are of too ancient a date to be useful and have simply been returned for their metal, and may come out again in life as eighty tonners. They are arranged in rows and piles and have a forlorn and deserted look. The yard, however, wherein the prides of the arsenal are to be found, is very different and presents a picture of great activity. The huge cranes, that are used to move the enormous guns and place them either on the ground or on their car-

riage, stand gaunt and firm against the sky line. One hears the echo of the hammers and the grinding of the machinery, which apparently never ceases. One of the hydraulic cranes can handle a Woolwich Infant as easily as a mother can her baby, while the other has a limit of eighty tons to its capacity. Both are in constant use, for the guns are being perpetually taken to the butts for tests or else shipped off to different spots. They are both worked by a single man, and the sight of such huge power in the palm of a man's hand is very striking.

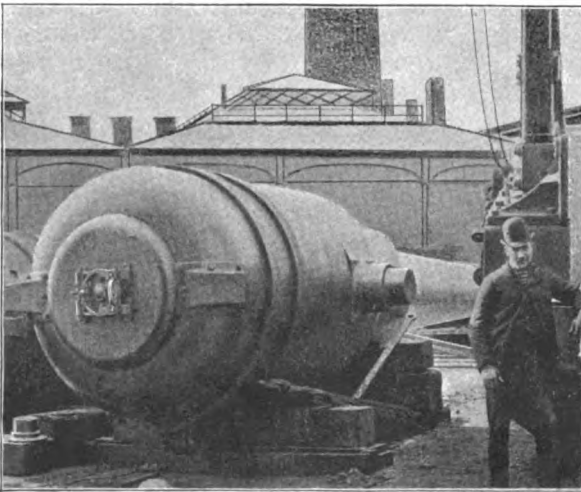
The gigantic hammer, however, is still more marvellous. It weighs no less than



CAPTURED IN CHINA.

forty tons, and can strike a 1000-ton blow, and yet its power is under such control and its movements can be so modified that the engineer who works it put his watch on the anvil and brought the gigantic mass of iron down full force on the timepiece, stopping the blow with such skill that the watch could just be pulled out from between the hammer and the anvil, with the glass unbroken. It was suggested that I put my finger there, but I declined.

Those who have never seen a really big cannon can hardly imagine the size of the Woolwich Infant. There was only one of these promising children there when I paid my visit, but the family is not confined to one child. The length is forty-seven feet, and we could not get the whole of the gun on the plate. Some relative idea of the size can be seen from the man who stands by the breech. This gun can carry a distance of fourteen miles, and can be sighted to insure that distance. It consumes when fired 800 pounds of powder, and the projectile weighs no less than 1700 pounds. The cost of each firing is £100 sterling, and the concussion shakes the ground for miles around. The gun, of course, is not made in one piece. If it were, gun-making would be an easy job. I forget how many different pieces are added, but I think there are seven—in all, either seven or eleven. Of course, the boring is the great work, and this takes a tremendous time.



THE 100-TON GUN USED AT THE BOMBARDMENT OF ALEXANDRIA.

By a very clever arrangement the centre-piece that is bored out is used to make a smaller gun, being in its turn bored out.

The difficulty in handling these enormous guns is great, but the hydraulic lift moves them with consummate ease.

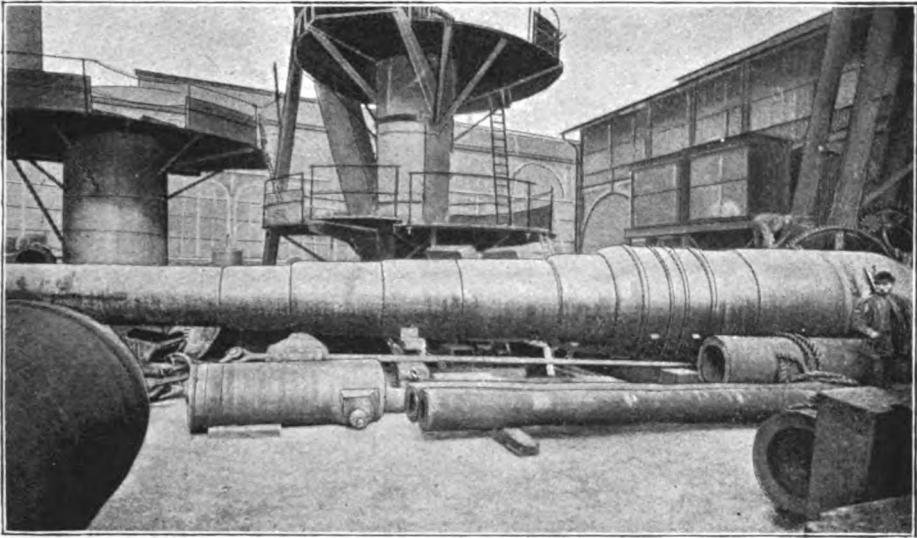
One of the interesting guns in the yard was the 100-ton gun which was used to such effect at the siege of Alexandria, and is one of the few guns of its class that have ever been used in action. It was sent home for repairs and has not yet been re-issued.

One of the neatest and most shapely guns in the yard was a sixty-seven tonner mounted on a truck, to be sent away to Devonport. It had not the gigantic appearance of the Infant, but seemed more symmetrical. A number of these are scattered around for coast defence, particularly on the south coast, and when one sees the size and notes the weight of the projectile they carry, one wonders that Portsmouth or any other naval yard can turn out ships that can withstand such a mass of iron.

There is something fascinating in watching the slow, apparently irresistible progress of a huge boring or planing machine. It moves slowly, very slowly, but the gigantic force with which it slowly eats its way through a mass of iron always strikes me as one of the greatest evidences of mechanical force imaginable. The big planing machine at the arsenal was at work when I was there, and it was cutting off a gun of about sixty tons, shreds that were not thicker than a piece of paper. It was trimming it down.

Near by was a lathe doing the same work, and the machine was working so slowly that I asked the reason, being told that if greater speed was used it would generate too much heat. So with the boring machines, of which Mr. Scannell took two excellent photographs that show what the machinery is like.

From this we went to the gun-pattern room, where all the models of the guns are kept. Here all the different methods are explained, and the various kinds of batteries, from a siege train to a camel



A "WOOLWICH INFANT," 110 TONS.

or mule battery, can be seen and the various ways of firing them shown. One in particular was interesting. It was a section gun to be used for mule or mountain work, the gun divided into two sections, each of which was a burden for one mule, and by a very simple arrangement they can be joined and made ready for use.

The Moncrieff gun is also a very ingenious and interesting gun to examine, and is bound to be successful.

However, the whistles again began to toot, and a glance at the watch said it was nearly 5.30 o'clock, a fact that a closer inspection of the light might have told me before. The workmen commenced to put away their things for the night and to don their going-out clothes, and I came to the conclusion that the Woolwich arsenal was closed to me for the day, and that if I wanted to see more of its wonders I had better come back some other time.

## HER WEDDIN' GOON.

BY ISABEL GORDON.

MARG'RET sae bonny, sae sweet an' sae fair,  
 Wi' the sun's ain glint in her curly hair,  
 Will wed wi' me the morn.  
 Last nicht Marg'ret showed me her sweet weddin' goon.  
 Gray, like far-awa' hills on a hazy noon,  
 Every stitch o' it dane by her ain dear han' ;  
 An' the grandest leddy in a' this wide lan'  
 Could never outshine her in that saft gray goon,  
 The gold braids on her heid like a duchess's croon.  
 At the neck an' the sleeves there's a wee bit lace—  
 She has nae need o' jewels tae gie her grace ;  
 There is beauty enow in her ain sweet face.  
 Nae fortune hae we savin' love an' health,  
 Twa herts leal an' pure—but is that no wealth?  
 I love her, I love her, an' she loves me.  
 What's money tae that or aught you can gie?