

# MAKING BIG GUNS AND ARMOR PLATE FOR UNCLE SAM.

## A Thousand Men Are Working Night and Day at the Bethlehem Iron Works.

(Copyright, 1918.)

A thousand men are working in three shifts night and day in the great shops at Bethlehem, Pa., getting ready guns for coast defense and for our ships. More than \$1,000,000 worth of war material is under contract for the Bethlehem Iron Works, and the furnaces are kept roaring for the 24 hours in every day. They are not in full operation, though, for they are under private contracts and government work together nearly \$500,000.

President Linderman, the head of the great company, is in Washington much of the time in consultation with the committee at the capitol, at the war department and at the navy department. While General Manager Joyce has his eyes on the huge hammers and presses and the enormous rollers which are pounding and squeezing and cutting the great surfaces of war into shape.

Four army and navy offices are constantly supervising the work for the government, testing it and approving it before it is accepted and sold. Captain J. Walker Hunt is in charge of the army inspection and Lieutenant W. M. Irwin of the inspection for the navy.

While they are on contracts for the government the Bethlehem works are practically part of the army and navy establishment. In fact, the government could take them in any great emergency and operate them entirely for the over-benefit. When the controversy over the price of armor plate arose in congress, this was advocated by some right members, but it was never considered seriously. Only a war emergency would warrant the government in taking possession of the plant. But provisions are taken that it shall not be open to general inspection, and it requires some diplomacy to obtain from the right side of the president one of the yellow slips of paper admitting you to the works. Without this pass you would be stopped by one of the watchmen and turned away. A high board fence surrounds the works, and at every gate sits a man in a blue shirt and they punch holes in your pass to show that it has been used.

On yellow slip No. 61, signed by President

After 20 inch, twenty-five inch guns and one 18 inch gun for coast defense, of which the 8 inch guns and some of the 10 inch guns have been delivered; for addition 20 inch and 24 inch disappearing gun carriages, of which 12 of the 10 inch carriages have been delivered for the gun forges for the navy, of which the large guns are to be completed at the Washington navy yard and the 4 inch guns at Bethlehem, and to finish up the armor for the Kearsarge and the Kentucky.

That doesn't look like a very big contract. But bear in mind Secretary Loring's estimate that each of the 20 inch guns on the Maine was worth \$1,200,000 and the contract here to assume a greater importance. Figure that the cost for a 20 inch gun are worth \$1,200,000 and that it takes \$100,000 more to assemble the parts and "machine" them, that the 10 inch gun now making at Bethlehem will cost the government at least \$175,000 before it is completed and that every lot of the armor plate made for our battleships is worth \$200,000 and the work being done there assumes immense importance. What its importance is in 10 days of our war has been something beyond comprehension. It was not so many years ago that we had to get our castings from abroad, and in times of war without the great Pennsylvania steel works which now supply the material we should be unable to get on with the production of heavy ordnance. This is the more acute in view of the fact that the great armor gun must be rebuilt after 100 shells and a casing after 100 or 200 have been fired.

The armor plant of the Bethlehem works are worth more than twice that

of the Lehigh Valley railroad, and the Bethlehem Iron works is a regular station on that road, a town of itself.

Between the buildings is a network of tracks connecting with the railroad company's yards. These tracks connect with all the great buildings, so that coal and metal can be delivered from the mine directly to the point where they are needed and the product of the works can be taken from the finishing shop direct to its destination. Among the buildings runs also a narrow gauge road, on which a dummy engine switches cars from one house to the other. For you must remember that a 22 inch gun weighs 37,000 pounds, and in handling first its parts as they are developed and then the completed gun enormous power must be used.

Scattered here and there about the works are piles of debris, pieces of rods, and near the casting house are great castings, whose jackets are being cooled by a stream of water pressure to their removal.

The system of transportation extends into the shops and through them, and in the foundry, the forge building and

the great machine shops are overhead tracks, on which run great cranes. The iron of steel as it is being fabricated by the gun tapers or gun hoist is picked up by three cranes and carried from one place to another within the shops, and as it is necessary to move it from one shop to another it is loaded on a car and hauled by the dummy engine to its destination.

Steam hammers are familiar implements to any one who has lived in an iron working community. Visitors to the World's fair saw them in operation, and lesser exhibitions have shown them. But no such hammer as the one at Bethlehem exists anywhere in the world except at Bethlehem. The Krupp works have a larger hammer now, but the Bethlehem hammer was the largest in the world when it was erected. It has a falling weight of 115 tons. For four years it has stood idle and useless. It is so big that it jarred all the machinery in the other buildings, firm as the foundation are and drove the tools of the great gun lathes an inch deep into the tough steel.

There are smaller hammers in the

white, deadlly brilliant, leaping and spouting above the furnace flames. This sea is being raised slowly in a temperature of 2,500 degrees F. When it has reached this point and a little has been drawn off and cooled completely, the mouth of the furnace is opened, and flowing like a living flame, sending showers of sparks in all directions, the metal runs down into a "chute." This chute is so narrow from the office it pours from, but in general appearance it is unlike any chute you have ever seen. It is a tank about seven feet wide, with an opening at the top and, unlike the lathes of household use and fairs, an opening at the bottom. This tank runs on wheels of steel on tracks which are laid on each side of the casting pit. It holds 50 tons of molten metal.

When the ladle is full, it is run down the track to the place where the mold is lying ready. Men, walking at each side, pry with levers of iron under the wheels, keeping at a respectful distance from the superheated tank. In this way the ladle is pushed along, and the crucible, which the wheels support, the vent is just above the opening in

metal homogeneous. Before the ladle is poured, it is tested for its purity, because that part of the metal that is left at the top, and that which is cut from the bottom of the ladle, may have some impurities which may be present in the mold, is no more than 10 per cent.

The ladle is left in the press for some time after the pour has ceased to flow. Then it is taken to the furnace room, and there, within the mold is broken away, the metal is poured into the mold, the ladle is removed in a few minutes, and the ladle is ready to be made into a new form.

The first step in the forming is to make a hole in the big solid block. This is done by cutting a hole through the metal. These are done in a lathe, which is a machine which cuts a hole through a piece of metal. The most solid of molten steel, however, when the work is running under heat as they are, the lathes are usually

President Linderman, president, I went through the great shops and watched every step of the operation of making one of the great guns which are to keep fighting battleships at a respectful distance from our coast in time of war.

This was read:

**THE BETHLEHEM IRON COMPANY,**  
Bethlehem, Pa.

No. 20 Mill Beaver is the following Department:

Machine Shop No. 2, Machine Shop No. 2, Forge Building, Hammer Building, Cast Iron Shop, etc.

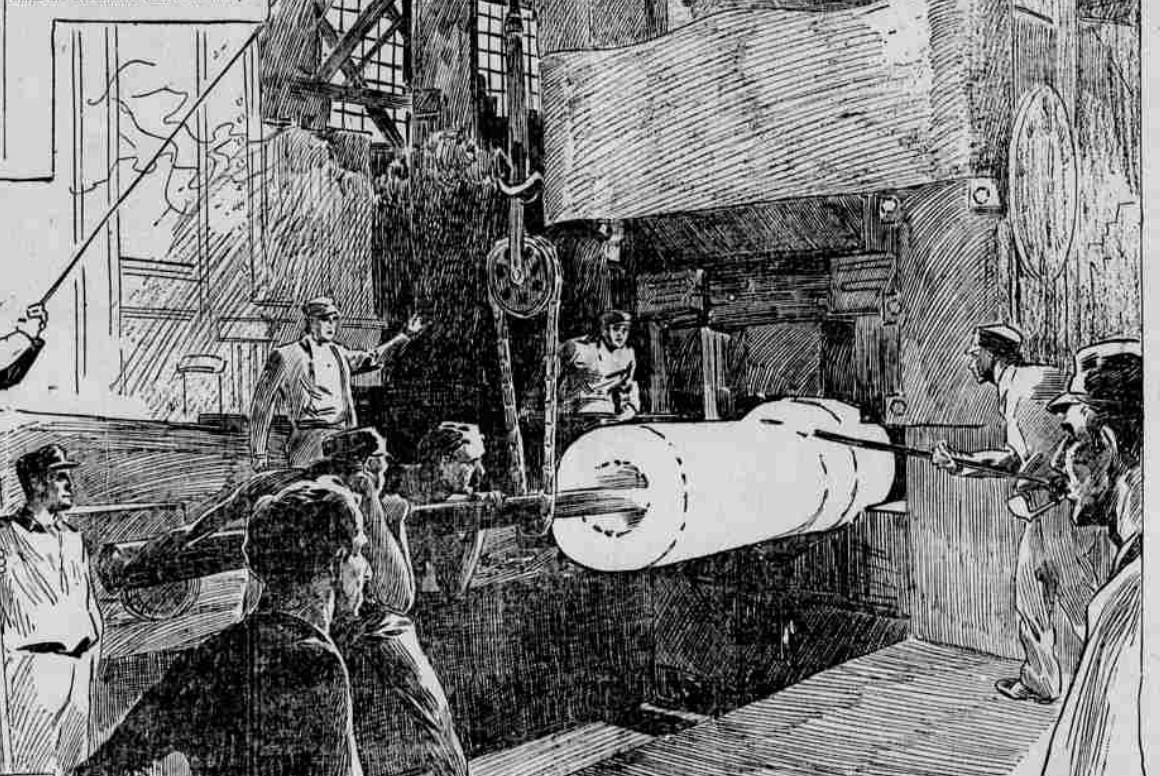
ROBERT F. LINDERMANN, President.

Good this day well.

Let me tell you briefly what war work the Bethlehem works are doing for our army and navy before I begin to describe the progress of a piece of metal from the furnace to the finished gun.

The government of the United States has its own gun factories, one at the navy yard in Washington, the other at Watervliet Arsenal, New York. It has no means of making castings for great guns, however, and its armor plate factories, which get their armor plate from private contractors, and the parts of its great guns come from one or other of the great steel works of Pennsylvania. The great of these works is at Bethlehem, and here are made the castings for the guns which are turned out at the Washington navy yard and at Watervliet and many finished guns as well.

The contract on which the works are now engaged is for twenty-five 8 inch



FORGING THE BIG GUN.

building with the large one, which are in use to shape the massive castings, but most of the work on the gun castings is done by steady pressure and not by blows. The great presses—one of them exerts a pressure of 14,000 tons—are as spectacular as the hammers. But most impressive of all is the casting room, where molten metal flows in a shower of sparks from furnaces and ladles, seething and glowing in the molds.

Ingate for the great coast defense guns are made at Bethlehem from Whitworth's open hearth steel as you can learn from your own photographs. I shall tell you only how it looks, first as it becomes a fluid in the glow of the great gas furnace and then as it passes to the molds in the pit below the building floor.

The furnace is at the top of the glowing building. It is a long building, dimly lighted, black with coal dust, and showers dust and mud on you as you enter it. Working on a steel furnace is a smelly business, and the gases from coal and metal make it a suffocating business too.

You can look into the furnace where the steel is melting through little holes, but you must look through blue glass if you would save your eyes from a glare more brilliant than the sun. Through this glass you look on a sea of white

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**BOOKS AND BOOKMEN.**

Rev. Luther Humphrey, who died in New Hartford, Conn., recently, was a cousin of the famous abolitionist John Brown. The greatest of these works is at Bethlehem, and here are made the castings for the guns which are turned out at the Washington navy yard and at Watervliet and many finished guns as well.

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in secure him a professorship in Edinburgh university.

Two newspapers of the Times Arnold will soon be killed in his native town in the case of White—here is the Church of St. Mary and a tablet on the house at West Chester.

Ferdinand Brunetiere, editor of Le Reveil des Deux Mondes, who during his involuntary changed it to —

for 1887. The lectureship was established in Henry VIII's time, to be held by a learned man, and philosopher forever.

The people of the United States supported and read more newspapers than England, France and Germany combined.

H. W. Hoch, a well known editor of Kansas and twice a member of the leg-

lature, has refused the appointment as postmaster of his town because he would have to work on his farm on Sunday.

Mitville D. Post, who was widely commended for pointing out the loopholes through which criminals may escape, in his book "Strangest Schemes of Randolph Slane" has written another book of the same kind. He says that no one should

be censured for pointing out the vice and shortcomings of the law. He is noted as an interesting lecturer. It is noted as the American Captain Mearns' book on "The Influence of Power in History," in which he points out the influence of power in history. The pope speaks Italian and French perfectly.

As you watch the glowing pressure on under the press you see that the tube is growing thicker and larger and longer. The pressure does slow expansion if at the sides and it turns around and around it is expanded at every point until the trained eye of the workman sees that it is of the right shape for the mold. This it is done from the press, still on the model, as carried by one of the overhead cranes to a furnace, where it is heated and is of a salmon pink. The right temperature is recognized by the sight. When that is reached, the tube is heated in the furnace and placed into a bulbing tank of oil. After that it is put into an annealing furnace, where one of wood completes the process of tempering it. The temperature of this process is very great, for it is the government inspectors who test here, being satisfied that it is below the high government standard it is rejected, and the means a loss of several thousand dollars to the makers.

The forgings for the 18 and 22 inch guns are delivered at the Watervliet Arsenal in the month. They are 11 forgings for a 12 inch gun. They range in weight from the trunnion bolt which weighs 3,000 pounds to the nut and locknut which weigh more than 5,000 pounds each. The aggregate weight of the 11 forgings is 117,000 pounds. The complete gun metal weighs about 13 per cent of the 10,000 weight of each being removed in the machine shop.

The 12 inch gun, too, will be assembled at Watervliet, but the assembling of the smaller guns is done here. The piece is turned and lathed to the proper dimensions on the lathe. The jacket and hoops are shrunk on the tube, which has been heated in the hot oil bath by one of the great cranes is lowered into it. When the jacket of hoops, cooled, it contracts and the tube and hoops are pushed apart. By the shrinking of the jacket on the tube and the hoops on the gun are known as "built up" guns, and they have a resistance that was never dreamed of in the large gun were made at that time. The largest of these built up guns was made in 1860. It weighed about a few weeks ago, it weighed 12 tons, and its cost was \$150.

The making of the breech mechanism is another complicated undertaking. It is the building of the breech mechanism. All these have been made in the past in recent years, however, and the breech mechanism is now being made in the building can now be turned out ready for service in one-third of that time.

GEORGE GLANTHAM BAIN.