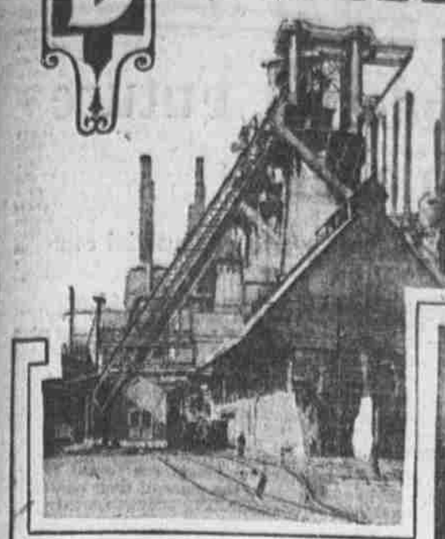
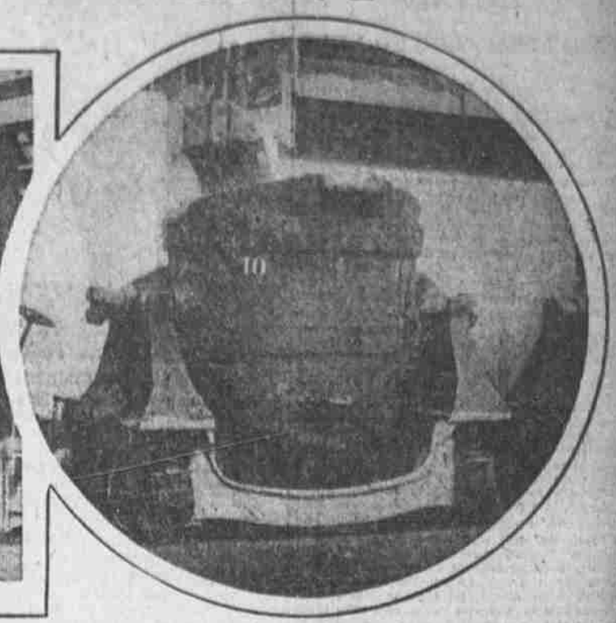
BETHLEHEM STEEL AMERICA'S GREATEST STEEL PLANT

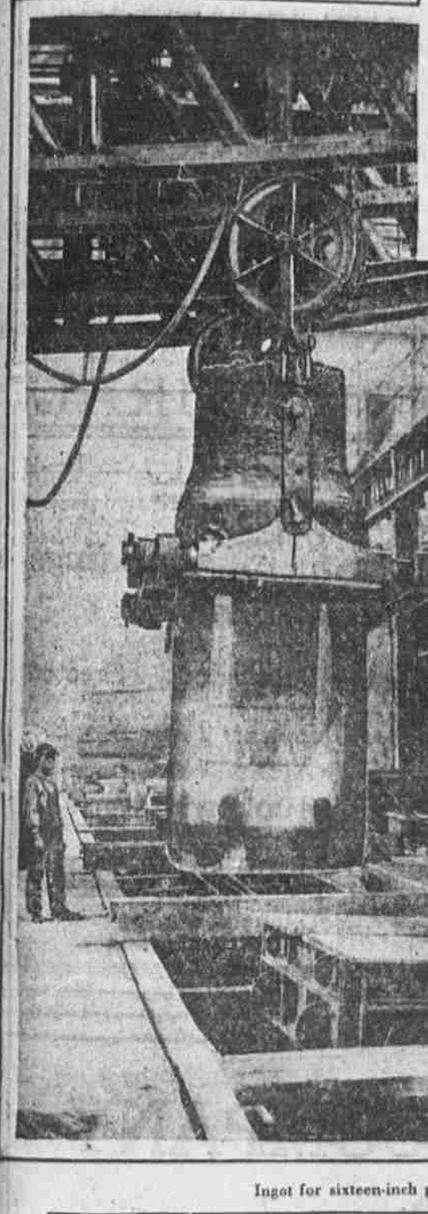


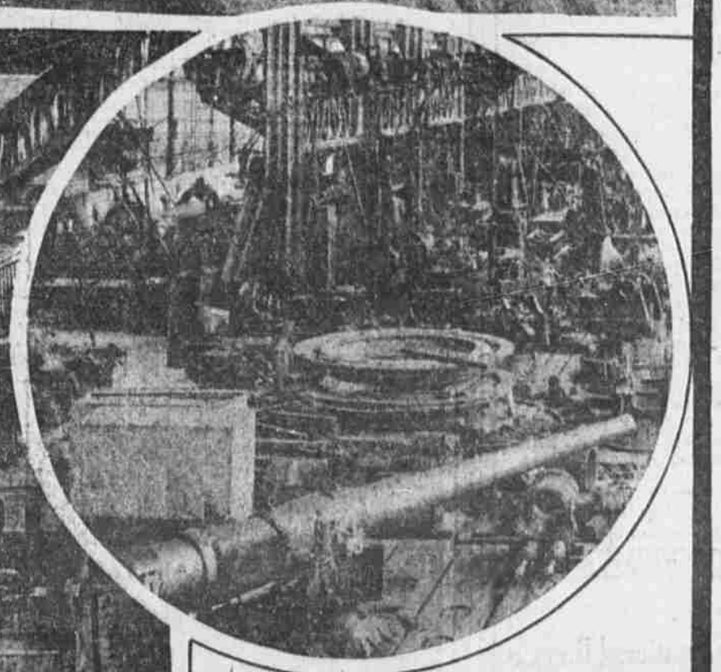
Some of the blast furnaces

Charging the open hearths



Tapping a furnace





A corner of gun shop

Ingot for sixteen-inch gun

THE plant of the Bethlehem Steel Company at South Bethlehem, Pa., is beyond question the most modern, complete and self-contained in existence. Every pound of pig iron and steel used therein is locally produced, there being in unceasing operation for this purpose five 500-ton and one 250-ton blast furnaces for the production of the pig iron, with an additional 500-ton furnace in the course of construction; thirty-two open-hearth furnaces, with a capacity of from fifteen to seventy-five tons each, and three Bessemer converters.

Present ore requirements approximate at 2,000,000 tons a year, a figure that promises to be materially increased when the company has successfully consummated its plans for the sale of Bethlehem pig in the open market.

The ores used at Bethlehem, owing to abnormal conditions, are brought from many fields at present, but after the war the company expects to obtain by far the larger proportion of its ores from Chili and Cuba, where it has invaluable and what are believed to be inexhaustible holdings, bringing them to New York by its own fleet of steamships.

Bethlehem has a splendid system for discharging the ore, the outstanding feature of which is the twin ore bridges or conveyors, which have a span of 550 feet and a traveling area of a thousand times their span, permitting them to convey the ore to any desired point.

So interesting is the entire method, indeed, that a brief untechnical description would seem to be imperative. First, the cars are run two at a time into a cylindrical device that turns over and precipitates the ore into the pit. Here it is picked up by a fourteen-ton grab bucket—a part of the equipment of the bridge—and carried to a designated pile, all the ores being kept apart. As needed it is mechanically loaded into eight-foot gauge electrically propelled cars and conveyed to the blast furnaces. Here it is dumped into hoppers, then loaded into the skips and carried to the top of the furnace by incline and emptied on to the top of the upper "bells," each of these processes being automatic.

In the old-type furnace there was only one "bell," the technical designation for the cup-shaped receptacle into which the ore, coke and limestone are placed, and which, by dropping and revolving, empties the same into the furnace, consequently when the operation was in progress, there being no barrier against their escape, the gases, forced by combustion, would rush skyward as though impelled by omnipotent force.

What a tremendous waste of energy this escape spelled can be readily understood when it is stated that there are generated in a blast furnace 150,000 cubic feet of gas to every ton of pig iron produced.

In the modern furnace there are two bells, one over the other. The material is first placed on the top of the first bell, which revolves and drops it on to the bell below, which is not dropped until the first bell has been reversed into position again, consequently when the second bell empties its load into the furnace the tremendous gas pressure, instead of escaping, is confined within the furnace. Thus today it is estimated that more than ninety-five per cent of the waste gases of the Bethlehem Steel Company's furnaces are utilized in producing the 80,000-odd horsepower required to operate this gigantic plant—this meaning all of the dynamos, motors, cranes and other mechanical equipment, these gases being passed through washers to cleanse them of impurities.

And this statement leads us to digress for a moment to apostrophize on what is without question the most wonderful private power plant in America—the plant that is the motive force behind all the activities of this extraordinary and much diversified workshop.

Developing approximately a hundred thousand horsepower a year, the nine powerful Bethlehem constructed gas engines drive the huge General Electric Company generators that turn all the wheels of every department of the plant.

The Bethlehem gas engine is a triumph of engineering.

One of these gas engines has thousands of parts, and virtually all of them are manufactured from steel, even the cylinders, the Bethlehem Steel Company, by the way, being the only plant in the world to cast a steel cylinder in a single piece. Also it has built the largest cylinders of any kind ever made.

Pumping engines are another product of the power department, among the recent notable installations being the great 27,500,000-gallon pumps of the city of Baltimore's new water system.

Besides its outside orders, the Bethlehem Steel Company is at present constructing forty-four large-type gas engines for its subsidiaries at Steelton and Sparrow Point, and has sufficient work on hand for more than two years to come.

The Bethlehem Steel Company's power plant is being increased at present by an addition of five more gas engines, which will bring the aggregate development up to about 125,000 horsepower. Also there is being installed a sprinkling plant to cool off the water used in the gas engines. Heretofore about 150,000,000 gallons a month have been used in this operation, and it has been found necessary to pump it from a point in the river two miles below the station. The water, of course, has gone to immediate waste. Under the new system, however, it will be possible to utilize the same water over and over again. The loss through evaporation will be, it is estimated, about five per cent. This means that only 7,500,000 gallons a month as against more than 5,000,000 gallons a day will be required, and that will be siphoned from the river at the site of the plant.

The entire Bethlehem plant uses more than 2,000,000,000 gallons a year.

One could not justly leave the subject of power without at least a reference to the splendidly appointed power plant, with its green-enameled engines, with their brass-protecting railings and nickel-driving rods, its red tile floor, its centrally located switchboard-operating gallery of remote control—constituting, all in all, the most eloquent encomium that could be adduced as to the surpassing efficiency of the mighty industrial plant whose myriad wheels it turns.

But to return to the blast furnaces. In the smelting of iron there are three chief agencies besides the ore itself, these being coke, lime and compressed air.

More than a million and a half tons of coke are consumed annually, the coke being obtained from the ovens of the Lehigh Coal Company, two miles below the plant.

About seventy per cent of the resultant iron is used in a molten state, the remainder being made into pig to fill the general plant requirements.

For the most part the molten metal is carried in huge ladles to the open-hearth furnaces, about sixty per cent of it being first passed through the Bessemer converters, which reduce the carbon content and eliminate a large proportion of the manganese and silicon, the open hearth materially reducing the phosphorus.

Part of the charge in the open hearth is pig iron, part steel scrap, the proportion depending mostly on the relative value of scrap and pig iron on the open market.

With the exception of some 25,000 tons of metal sent in a hot state to the steel foundry, the entire annual output of the Bethlehem Steel Company, amounting at present to more than 1,000,000 tons, is cast into ingots—these ingots, weighing anywhere from 2500 to 200,000 pounds each—which are rolled into bars, rails and structural shapes, or forged into gun parts, presses, shaftings and the countless other products necessary to the successful conduct of the plant.

No steel plant in the world, perhaps, has a more extensive or better equipped foundry than that of the Bethlehem Steel Company.

Said to be the largest individual foundry in the country, it can produce any character of casting demanded by present-day industry, whether of steel, iron, copper, brass or bronze.

Nor does it place any restrictions as to size, having facilities to make both the smallest and largest castings used in the manufacture of its many diversified products. It holds the record of the world for the largest castings in both steel and iron. Both of these were made for the Carnegie Steel Company, the iron casting being a 230,000-pound cylinder holder for a huge hydraulic press at Homestead, that of steel, 876,000-pound platen for a press at the McKees Rocks plant.

The copper, brass and bronze castings, which are made in all forms, are used chiefly in the manufacture of ordnance.

As has been stated, the metal for the steel department is brought in a molten state direct from the open-hearth furnaces. For the iron department, however, it is heated on the ground, there being seven cupolas, with a capacity of from 25,000 to 250,000 pounds each, for this purpose, these being charged with anthracite coal and coke. The copper, brass and bronze are also refined at hand.

The foundry is equipped with four large annealing furnaces for the removal of internal strains, many electrically driven saws and planers and a modern oxy-acetylene outfit for the cutting away of the sinkheads and other superfluous metal.

The ingots for the rolling mills are made specially for each product in order that they conform with specifications in carbon content, manganese, sulphur and phosphorus that enable them to comply with the tensile strength requirements.

Before being sent to the blooming mill to be rolled into billets, slabs and blooms, the ingots go to the soaking pits, where they are heated to the desired temperature. From there they are sent to either the rail, structural or bar mills.

The company has ten bar mills in operation at present, rolling from a quarter-inch to a six-inch bar in rounds, squares and flats, either in straight carbon steel or alloy. The tonnage of these mills amounts to about 200,000 a year.

Really a unit of three mills, all interconnected, the gray mill for the rolling of structural shapes is the largest and most up-to-date in the country. Its production is about 300,000 tons a year at present, which with a second mill for smaller shapes gives the company a capacity of 450,000 tons, soon to be materially increased.

The rail mills have a capacity of about 25,000 tons a month.

The forging department of the Bethlehem Steel Company has no counterpart on this continent, either in matter of equipment or in ability to undertake the biggest and most intricate work. The huge hydraulic presses employed here are as powerful as any to be found in the world, the great 16,000-ton press for the forging of armor plate being at least 1000 tons heavier than any yet built. There are three other big presses in this plant, their respective tonnage being 6000, 4000 and 2500, and about a dozen smaller with a tonnage of 1000 and less, not to mention a large number of steam hammers with a range capacity of from 100 pounds to 125,000 pounds.

One of the celebrated forgings made by the Bethlehem Steel Company was the shaft of the old Ferris wheel—about 99,000 pounds—at the Chicago Exposition, reputed to be the largest straight forging ever made. This plant also made the largest cradle-shaft ever forged in the United States. Propellers and crank shafts for ships are made here in large number, the company specializing particularly in the hollow-forged type. Its forges range in weight from one-pound shells to the extreme size. Besides the ordinary open-hearth steel, every character of alloy steel is also employed in the manufacture of forgings.

The making of the forgings is another of the many interesting processes. The ingots after pouring are permitted to remain in the open-hearth department just long enough to permit their congealing to a solid state. They are then loaded on cars by crane and conveyed to the forging department, by which time they have about reached a proper forging temperature. They are mechanically placed under the presses, which with wonderful speed fashion them into shape.

Next the forging is annealed, then roughly machined, after which it is subjected to a refining treatment, consisting of heating to a stated temperature and applying to a cooling medium, generally oil. Then it is again heated, this time to a somewhat lower temperature, a process known as tempering, after which physical tests are made for tensile strength, elastic limit, elongation and contraction. If the forging passes the tests it is finish-machined and given a rigid service inspection.

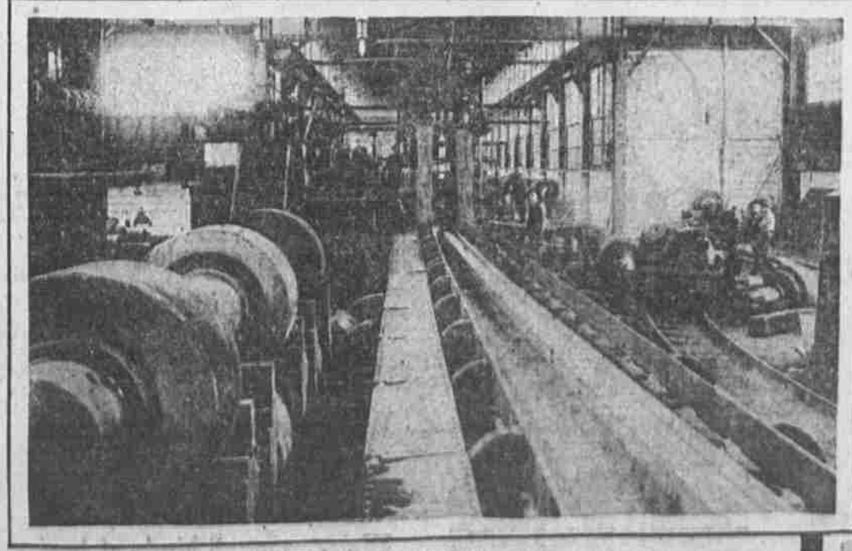
In speaking generally of the treatment of metals, it would not seem inappropriate to mention briefly the unusually efficient metallurgical department maintained by the Bethlehem Steel Company.

Employing all told a force of ninety men, this department has exceptional facilities not only to perform satisfactorily the regular routine work, but to conduct pioneer work in the field of experiment.

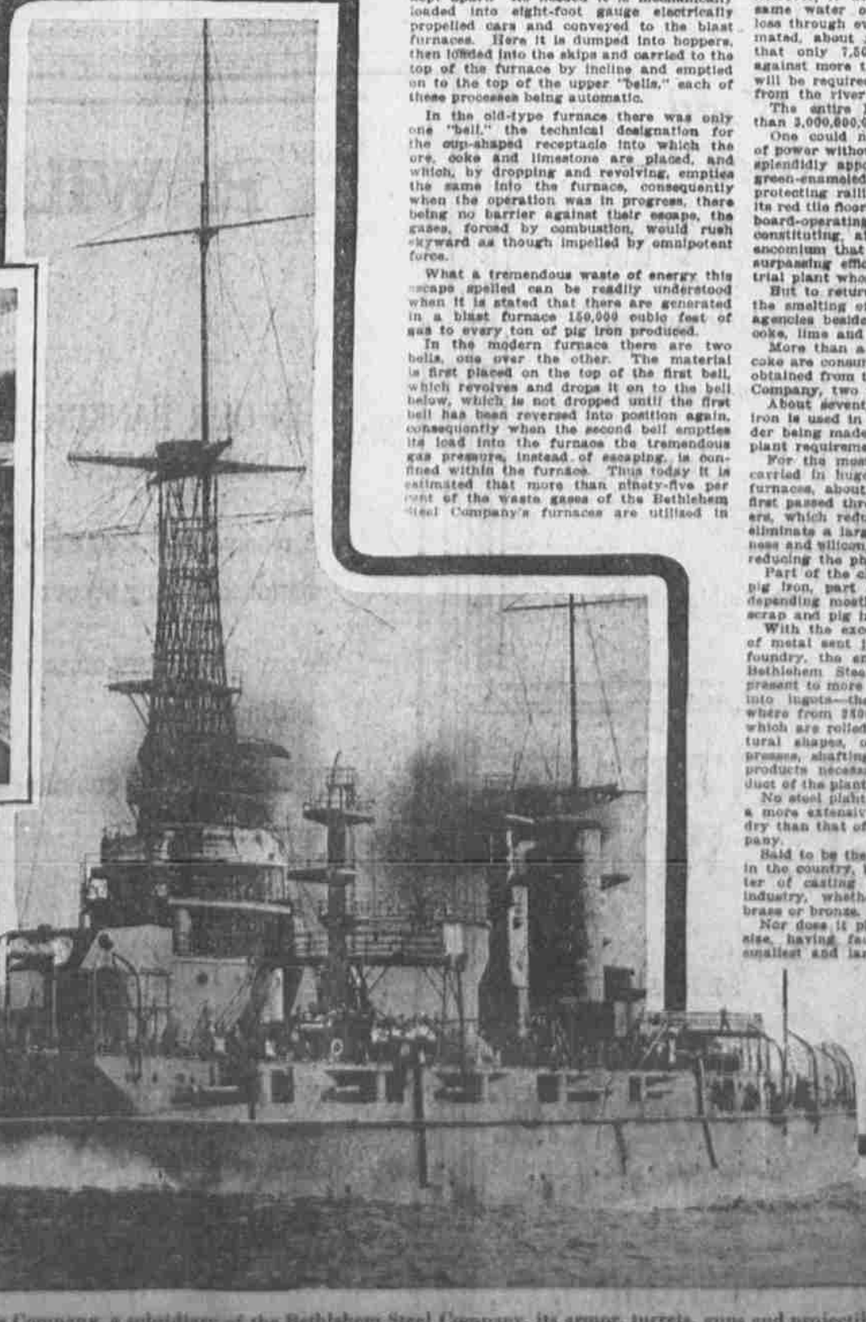
The company is unceasing in its endeavor to improve the quality of its steel, and to this end a force of neutral men is constantly employed, their province being to keep in touch with the products and to experiment in the direction of improvement.

This department also analyzes all the raw materials used in the plant, including coals, coke, oils, ores, limestones, etc., besides making the analyses followed in the manufacturing of the different steels.

In the Bethlehem steel machine shops are thousands and thousands of lathes, the largest and smallest in existence, and all the equipment necessary to the successful conduct of a modern plant.—Advt.



The gray mill and the famous Bethlehem beam



The battleship Rivadavia, built by the Fore River Shipbuilding Company, a subsidiary of the Bethlehem Steel Company, its armor, turrets, guns and projectiles all products of Bethlehem