ORDNANCE

U. S. Naval Gun Factory Is Rushing Production Again

Washington Arsenal, Only Plant of Its Kind in U. S., Guards Its Complicated Process for 16-Inch Pieces

See Front Cover

WASHINGTON, D. C., is not an industrial city. It was planned that way from the beginning. Yet there is in Washington a factory that manufactures heavy steel goods. It is a big factory, employing 7,700 men. It makes only one line of merchandise, and it has only one customer.

Guns for the Fleet! That tells in a phrase the business of the Naval Gun Factory, busier now than it has been for a good many years. The lapse of the naval limitations agreement, and the resumption of battleship construction, has brought the first wholesale orders for 16-inch guns that the factory has had for a couple of decades.

The new battleships for the U. S. Navy are on the stocks now. They won't be ready for launching for many months yet, but as soon as they are, the giant guns will be waiting to be set in their turrets. If you could visit the Naval Gun Factory today, you would see dozens of those long, ponderous thunderbolt-hurlers of modern war, in all stages of preparation, stacked like poles in a telegraph company's timber yard.

They aren't the only pieces of ordnance in the factory. All sizes and calibers are there, smaller guns, piled up like cordwood. There are 3-inch and 5-inch anti-aircraft guns, 6-inch and 8-inch guns for the cruisers, and a scattering of 14-inch pieces from existing battleships, being reconditioned for further service. But the 16-inch guns are the real pets of the factory just now.

Wonderful Birth

The birth of a 16-inch naval gun is wonderful to watch—a marvel of modern metallurgy.

Heavy guns of the present day are not solid masses of steel. The fearful stress of the powder-gas pressure necessary to hurl the two-ton projectiles twenty miles or more would exact a penalty of disaster for a hidden flaw. So the gun is assembled out of several hollow cylinders or tubes fitting over each other. It is easier to make these thinner sections without dangerous flaws, easier also to detect such flaws, if they exist, and so eliminate faulty parts.

The innermost tube, the one through which the shell travels when the gun is fired, is called simply that: the tube. The other hollow cylinders of steel that are fitted over it to give it added strength are all known as hoops.

The Naval Gun Factory gets tubes and hoops as semi-finished forgings from the great steel companies. These steel masses are set in the gun lathes (and they *are* lathes; each one as long as a city building lot!), and turned off smooth, and accurate to the thousandth of an inch. The finished surface would serve for a mirror.

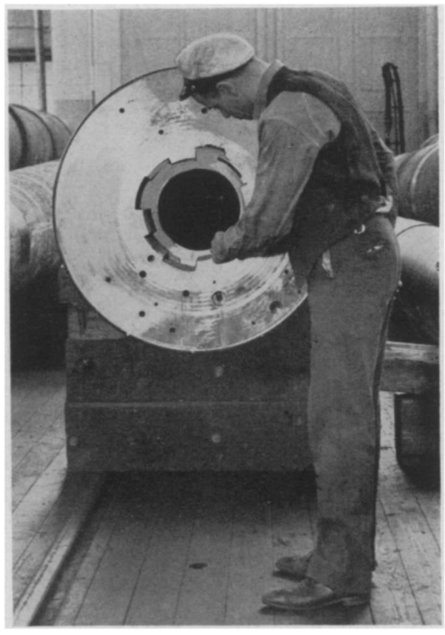
Inside as well as out, the hoops are bored out accurately, and mirror-smooth. They are made just a little smaller than the outside diameter of the tube over which they are to be set.

That looks just a wee bit difficult—worse than trying to get a size 12 foot into a size 10 shoe. How will they do it?

Hugs the Tube

Not so hard, after all. They just take advantage of the well-known fact that metal expands when heated. They heat the hoop in a tall, cylindrical electric furnace. They stand the tube on end, cold, in a pit a hundred feet deep. They lift the heated hoop out of the furnace and lower it over the cold tube. Then they let it cool—and shrink. The hoop hugs the tube literally in a grip of steel, adding the tremendous tension of the shrinking force to the natural strength of the metal.

The second hoop is heated, and shrunk over the first. The rest of the hoops are added in the same way, until the gun stands completed. Then it is lifted out of the pit, by an enormous traveling crane. It is put back into the gun lathe and the finishing tool gnaws away at its outer surface until it has the symmetrical profile of a finished gun.



ON THE LATHE

The Naval Gun Factory's lathes are tremendous machines, with beds as long as a city building lot. This one grips the tube of a battleship's heavy gun, on which machining is about to begin.

Heavy threads are cut into the thick metal of its breech, to receive the breech mechanism.

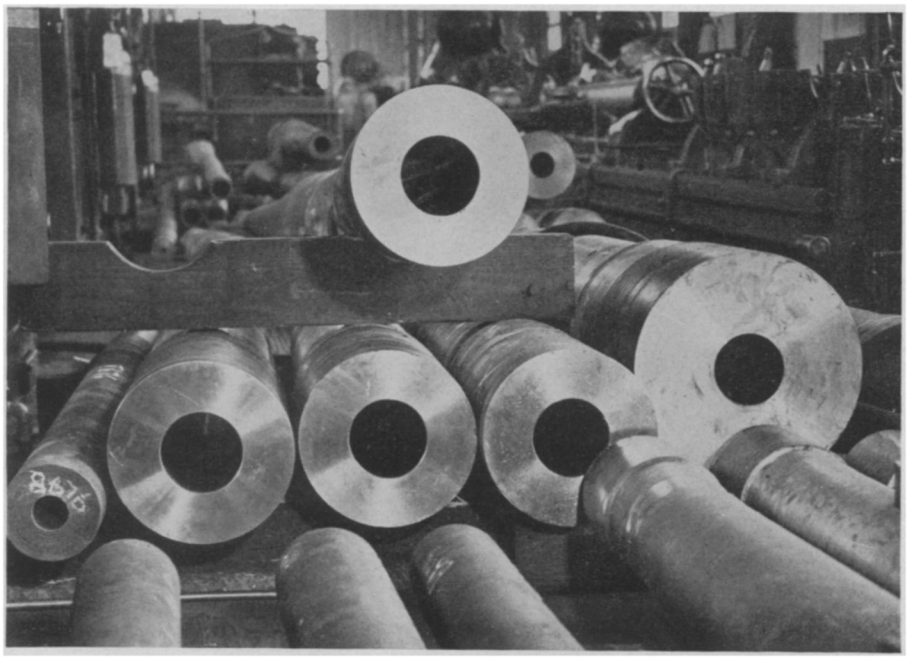
Now it is ready for the last and most critical of the operations, the rifling. To make the projectile travel on a true path, it must be given a spin. This is imparted by means of twisted grooves that run from breech to muzzle, with the exception of the chamber, or the part into which powder and shell are loaded.

A long, heavy rod, bearing at its end a cutting tool armed with diamond-hard teeth, is thrust slowly down the throat of the new gun. Just the right amount of turn is given to cut the grooves into the proper spiral path. Gauges go over the finished work, inchwise, seeking jealously for the least inaccuracy.

Approval

At last the inspector-officers nod approval. They can find no fault. The new gun is ready to join the Navy after successfully withstanding test firing at the Naval Proving Ground.

This elaborate job of building up a gun out of central tube and enclosing hoops used to be necessary for smaller caliber pieces as well as for the heavy ordnance of a battleship. However, within recent years advances in forging processes, and especially a method for



PILED UP LIKE CORDWOOD

These are small-caliber guns, in all stages of manufacture. Eventually they will become parts of anti-aircraft and anti-torpedo armament, or peer from the gun-houses of light cruisers.

building up tremendous internal pressures within the bore while at the same time the outer part of the forging was being shrunk, has made it possible to make guns up to 6-inch caliber out of a single piece of metal. This method, known as the "monobloc" system, has greatly increased the speed with which small-, and medium-caliber guns can be built, and at the same time has considerably reduced costs.

Science News Letter, February 25, 1939

AERONAUTICS

Transatlantic Air Service Planned To Start This Spring

Pan-American Expects To Run Two Roundtrips a Week, New York to London and Also New York to Marseilles

PAN-AMERICAN Airways expects to provide transatlantic air service four times a week at a total yearly cost of almost $4,000,000 to the government in the form of postal subsidy, the airline's application to the Civil Aeronautics Authority for permission to fly between the United States and Europe reveals.

Two flights in each direction each week will leave from New York or an alternate American port for Southampton or London, depending upon whether the Boeing Clipper or the Boeing Stratoliner is used. Two roundtrips a week are also to be made between New York and Marseilles, according to a schedule of operations expected to be in effect by the end of the first year of operation. Passenger service will start this spring.

Both flying boats and a landplane—the Boeing Stratoliner, 33-passenger ship now undergoing tests in Seattle—are to be used in maintaining service on such a frequent basis.

Revenue from an expected 2,338 passengers a year and from cargo will total about one and three-quarter million dollars, while operating costs plus return on investment will come to about $5,683,000, a financial statement attached to the application discloses. The difference, Panair officials are known to hope, will be made up by payments for carrying transatlantic mail.

Panair officials anticipate making only one survey flight preliminary to scheduled mail and cargo trips, several of which are to be made before passengers are carried. Six roundtrip surveys in 1937, plus the company's experience in more than a year of operation between New York and Bermuda and two years of flight across the Pacific eliminate the need for any further study.

Application

Information contained in the application constitutes actually the first such detailed announcement of the line's intentions. The schedules promise 19-hour service between New York and London in the Boeing Stratoliner, a 200-mile-an-hour four-engined landplane whose sealed cabin will not only allow stratosphere flight, but will keep the plane afloat in the event of a forced landing at sea.

New York-London service by the northern route in the Boeing Clipper will take twenty-four and a half hours. The return trip will take slightly longer because of prevailing winds. It will be flown over the northern route, via Newfoundland and Ireland, only during the summer months.

The southern route, via the Azores and Lisbon to Marseilles in the summer, and to London as well in the winter, will take 43 hours. On this route, an overnight stop will be made at Lisbon. This is believed due to the fact that European facilities for night flight are not up to American standards.

Departures for London will be made every Wednesday and Saturday, Tuesday and Saturday departures from England for the United States. Clippers will leave an American port for Marseilles each Tuesday and Friday and will return Monday and Friday, according to the tentative schedule.

Besides the Boeing Stratoliner, four Boeing Clippers will be used. Of these, two have already been delivered, with the others scheduled to come along at the rate of one a month between now and May.

Science News Letter, February 25, 1939

Hamburg, Germany, plans to construct the world's tallest skyscraper.

Both Chaucer and Omar Khayyam were astronomer-poets.