TRIAL OF UNITED STATES BATTLE SHIP IOWA'S BELT ARMOR.

Within the past few weeks practical tests were made at the naval proving grounds at Indian Head, Md., to determine the efficiency of the belt armor and structural support protecting the water line region of the battle ship Iowa, now building. Primarily the tests were to determine the acceptability of a group of armor plates of which the test plate was representative—the requirements being that the sample plate should withstand the attack of two 10 inch armor-piercing projectiles, the first without cracking and the second without perforation; the striking or perforative energy being, in the first shot, equal to the penetration of 12 inches of simple steel and in the second shot equal to the perforation of 16 inches of simple steel and a 36 inch oak backing. In these two particulars the plate was thoroughly satisfactory.

The plate was 16 feet long by 7½ feet high, backed above the bevel, as shown in Fig. 1, by 5 inches of oak, and rested upon a structural counterpart of the Iowa's inboard water line region, slightly lighter than will be the finished craft and correspondingly weaker. The armor fastenings were of the most recent design, and such, most likely, as will be used on our new battle ships.

The target was subjected to four attacks, the effect of which is shown in Fig. 2. Two of the attacks were by the 10 inch gun, one by the 12 inch gun and one by the 13 inch gun, at the respective distances of 388, 383 and 378 feet.

The head of the first shot effected a penetration of 3¾ inches, the point being welded in, while the remainder was shattered into many fragments and cast to a considerable distance. Otherwise the plate was intact. Again the 10 inch gun and a similar shell of 500 pounds was fired, this time with a charge of 217·2 pounds of powder, a striking velocity of 1,856 feet a second, and a striking energy of 11,954 foot tons, and succeeded in effecting a penetration of eleven inches. No cracks were developed in the armor, and save in rear of impact, where somewhat squeezed, the wood backing was substantially sound. Again the point was welded in the plate, the plate was slightly "dished," causing the ends to move away ⅜ inch from the backing, and one armor bolt was driven to the rear and several armor bolt fittings loosened.

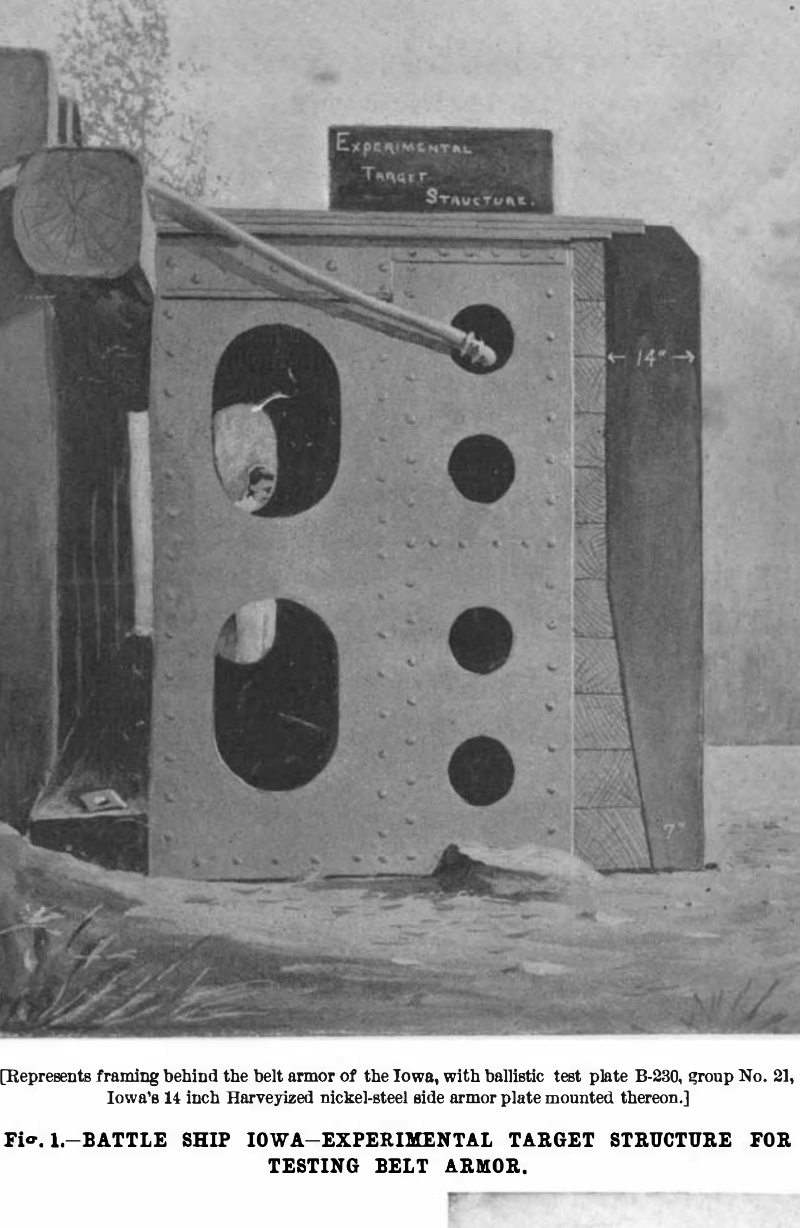
The third attack was made by the 12 inch gun, with a powder charge of 400·8 pounds, giving the 850 pound armor-piercing projectile a striking velocity of 1,800 feet a second and a striking energy of 19,114 foot tons—a force equal to the perforation of 19·39 inches of simple steel. The shot was destroyed with the exception of the part that effected the penetration of 17 inches. The plate was cracked through to the top and the bottom, and dished about an inch more. The neighboring wood backing was compressed to a thickness of one inch. Another armor bolt was driven to the rear; the backing plate at rear was bulged by bending of horizontal stiffeners within; but the target structure as a mass remained unmoved. The first attack had loosened eighteen bolts sufficiently to induce leaking, the distribution being about even between those with lead and those with leather washers.

The fourth attack was made by the 13 inch gun upon the remaining right hand fragment—a mass of about thirty tons. With a powder charge of 484·2 pounds, the 1,100 pound armor-piercing shell, with a striking velocity of 1,800 feet a second, a striking energy of 24,736 foot tons—a force equal to raising the whole ship as a mass over two feet—and a penetrative force equal to the perforation of 21·46 inches of plain steel, succeeded in passing through the entire target, two oak timbers of 16 inches thickness, and buried itself 12 feet in the sand butt to the rear, carrying the target as a mass back two inches. The armor was cracked through and through in three directions, shaking out part of projectile shown in Fig. 3, but the plate was unmoved. The structural plating and angles in pathway were torn and twisted into all kinds of shapes, denoting the superior character of the material, while the main part of target structure withstood the shock perfectly.

The projectile was warm when recovered two hours after impact, the point, as indicated in Fig. 3, was fused away and gone, the head marked with fine cracks partly through, while the whole shell was shortened three inches by compression and increased one-half an inch in diameter about the bourrelet. Pieces of the plate, weighing 500 and 600 pounds, were detached and driven into the structural part of the target.

The velocities were calculated to represent the full power effect of the 12 inch rifle at 2,300 yards and the like force of the 13 inch gun at 2,500 yards, the powder charges being reduced to that end.

Primarily the result shows the superior destructive power of the 12 inch rifle; but also shows the toughness and resistibility of Harveyized nickel steel, as was the armor plate, the structural efficiency of the supporting framework, and the vast amount of punishment that can be borne without irreparable injury; and further emphasizes the improbability of placing, at fighting range, so many large shots within so small an area, and with a normal impact. To the layman, the consequences are even more interesting when he knows that that heavy plate was backed up and held against those tremendous blows by a combination of plating and angles, the thickest of which was a double layer of half inch plates, while the others were a scant quarter.



[Represents framing behind the belt armor of the Iowa, with ballistic test plate B-230, group No. 21, Iowa's 14 inch Harveyized nickel-steel side armor plate mounted thereon.]

FIG. 1.—BATTLE SHIP IOWA—EXPERIMENTAL TARGET STRUCTURE FOR TESTING BELT ARMOR.

A Mountain Railroad in India.

A mountain railroad of great strategic value has just been completed by the British government in the Indian frontier. It runs through the famous Bolan Pass—in which so many English soldiers have perished—to the important post of Quetta. Ten years ago a railroad was opened from Sibi to Quetta, but this has proved a complete failure in consequence of frequent landslides. The new road runs over the old one at the start and the finish, but the sixty miles in the middle, which traverse the pass, constitute a short cut, and have been constructed in the face of extraordinary engineering difficulties. The highest point of the line is at Kolpur, 5,463 feet above Sibi, and 17 tunnels, varying from 100 to 1,000 yards, have been cut through rock or clay where the foundation seemed surest. Of these tunnels, that through the Panir Hill was the most difficult and important. It is 1,000 yards in length. If the tunnels on this line are important, the bridges are not less so, the main object to be achieved being the defeat of the Bolan River, which, when flooded, becomes a torrent, sweeping all embankments and bridges before it. There are many bridges of only a few yards in length, but the two most important are those called the Hanar and the Ocepur. These are each more than 150 yards in length, and they are 65 feet above the river when in torrent and are practically secure against the worst floods. To give an idea of the difficulty of the route, it may be mentioned that in the most difficult section of all—between Hirok and Kolpur—the Bolan ravine is crossed nine times in four miles.

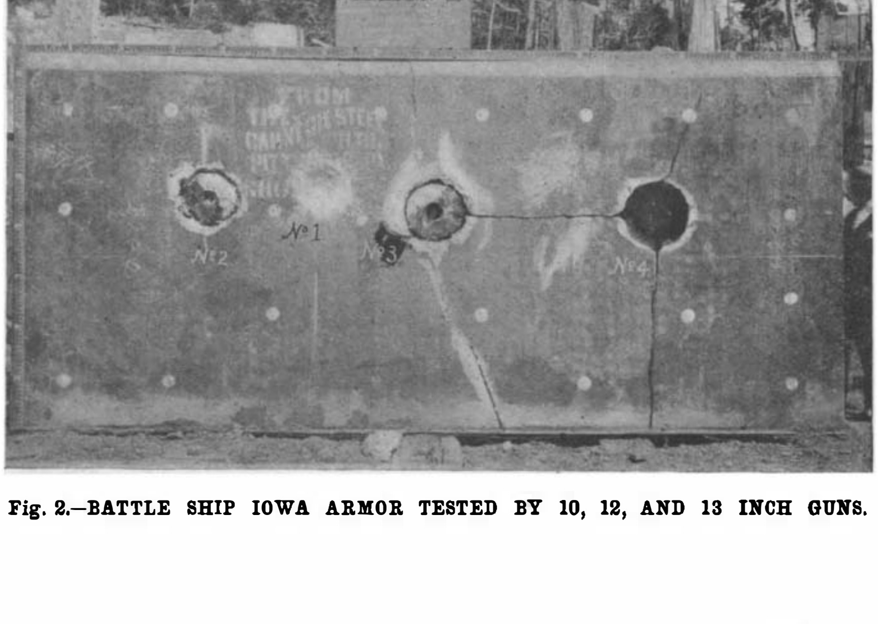


Fig. 2.—BATTLE SHIP IOWA ARMOR TESTED BY 10, 12, AND 13 INCH GUNS.

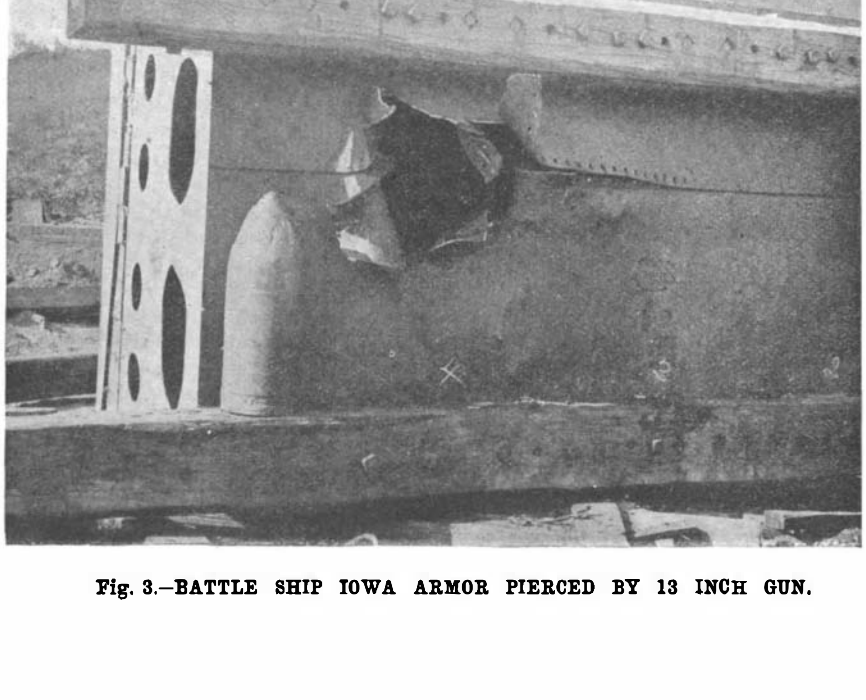


Fig. 3.—BATTLE SHIP IOWA ARMOR PIERCED BY 13 INCH GUN.