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Wilhelmshaven

Both of them had been working to the point of exhaustion since the *Seydlitz* had limped back into port. It had not simply been a question of repairing Dora and Emma turrets at maximum speed, but of devising a completely new ammunition-handling system for the entire fleet. Before the battle no one had imagined that ships could engage effectively at ranges of almost 20,000 yards; now everyone treated the idea

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as a foregone conclusion. Of course, what had given the concept its force was the havoc wrought by a single British shell, a shell that had not come straight at the *Seydlitz*'s armor-belted hull and broken up on impact as would have a shell fired at normal range, but which had followed the high arching trajectory required for maximum distances and gone *over* the armor belt, through the deck, and into a turret. It was the old mortar principle of lofting projectiles over battlements there were impervious to direct fire; but it was a totally new application of the principle: to a phase of modern warfare in which both the weapons and the targets were moving at high speeds and in constantly changing directions. All unnoticed, it seemed, gunnery technology had completely outstripped tactical theory, and having nearly lost a flagship in the process of discovering this fact, von Tiel and his colleagues were now faced with the urgent need to rethink all their old ideas about turret design, and to rethink them fast! (In this connection they were able to derive some small comfort from the knowledge that the British experience at Dogger Bank had probably not been such as to alert the Royal Navy to the existence of a similarly urgent need with respect to its own dreadnought squadrons.)

It was clear, to begin with, that the working chamber was a danger to the entire turret, not to mention the ship. So far from protecting against cordite flash, the chamber now stood revealed as a tinderbox. In fact the whole ammunition train, from magazine to breechblock, had been exposed as a veritable time bomb, and to defuse it von Tiel hurriedly designed a system of interlocking flash-tight doors at each stage of the loading cycle. Essentially the system worked on the basis that no door to a next higher stage could be opened until the door from a next lower stage had been closed. In addition, the number of cartridges permitted in any stage at one time was sharply limited, and, as a somber final note, the connecting doors between adjoining turrets were padlocked shut.

As to the guns themselves, von Tiel instituted one major modification: an increase in the angle of maximum elevation from 13½ to 16 degrees above the horizontal. This produced a corresponding increase in maximum range from 19,000 to 22,000 yards; for it was now plain to everyone that the worst one could do at long ranges was miss, and that if one granted one's adversary a monopoly of the early shooting, one might well be in no fit condition to fire if and when the ranges closed.

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Neglect air friction
(an assumption that would get your ship sunk quickly)

1. **What was the muzzle velocity of the cannon (use the 13 ½° case) .**
2. **Use 1. to predict the range at 16°.**
3. **Optional – do a web search on this subject, does it have a basis in fact.**