Profile Warship

37

SMS König

Editorially Speaking

Our readers have been critical of the recent lack of any Profile on World War I capital ships, and to these we offer the latest effort. The *König* class were the last dreadnought battleships to join the German High Seas Fleet before the outbreak of war in 1914, and only two more battleships were completed in the next four years. They represent the culmination of eight years of close rivalry with the Royal Navy, and a steady progression of design from the first German dreadnoughts.

The Germans had a deservedly high reputation for their systematic approach to capital ship design, and the author has tried to bring this out in his Profile. An interesting point which emerges is the high price which the German Admiralty paid for this excellence of design, since the *König*s cost 50-60 per cent more than their British and American equivalents. It should not be forgotten that the German ships had to face British ships designed to achieve a victory by sheer weight of gunpower, and it is therefore hardly surprising to find that German designers stressed protection. These German dreadnoughts were extremely tough, and *König* herself took 16 hits at Jutland, ten of which were from large-calibre shells. Apart from her armour, she was undoubtedly saved by the high quality of German cordite charges, which tended to burn rather than flash off.

The author is Tobias Philbin, a post-graduate research student at King's College, London. He has recently submitted a thesis on Admiral Hipper as a commander, and has worked on British Admiralty records and German archives in Freiburg. He has also served in the US Navy, principally in destroyers, and has contributed articles to the *RUSI Journal* and *USNI Proceedings.*

The artwork has been done by Martin Holbrook, a newcomer to the Profile series. It was based on the official drawings, but we were also lucky to have the very detailed drawings by Gunther Trenk, who has drawn a superb series of pre-1914 German ships. The ship was depicted as she was at Jutland, when German ships still carried torpedo-nets, and before the large tubular foremast was added.

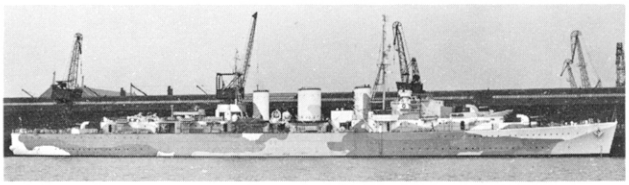
One of the problems with World War I ships is their lofty rig, which makes the artwork take up too much room vertically. This accounts for the relatively large open spaces around the artwork, and is something which cannot be avoided. For this reason also, battleships are now done in waterline profile only, because the underwater full-form takes up so much room. The double centrespread has proved so successful that it would be sad to lose this great advantage. The line drawing on the reverse of the centrespread is reproduced from the original inboard profile or 'längsschnitt' for *König*. These drawings were confiscated by the Inter-Allied Disarmament Control Commission in 1919, and retained by the Admiralty for reference.

Stop Press

It is gratifying when an author beats the public to the draw in pointing out errors. David Brown has told me to pass on to readers the following corrections to *Profile No 35:* on page 257 the 12ft rangefinders in Caption 2 should read 9ft ; on page 272 at the end of the list of Aircraft Ordnance, delete '24lb'. Those mines weighed between 1496lb and 1535lb, so I hope that nobody tried to pick one up. David would also like to warn the pilot of the Arado on page 217 of *Profile No 33* to start his engine before the green flag drops ; for 'ready' read 'preparing'.

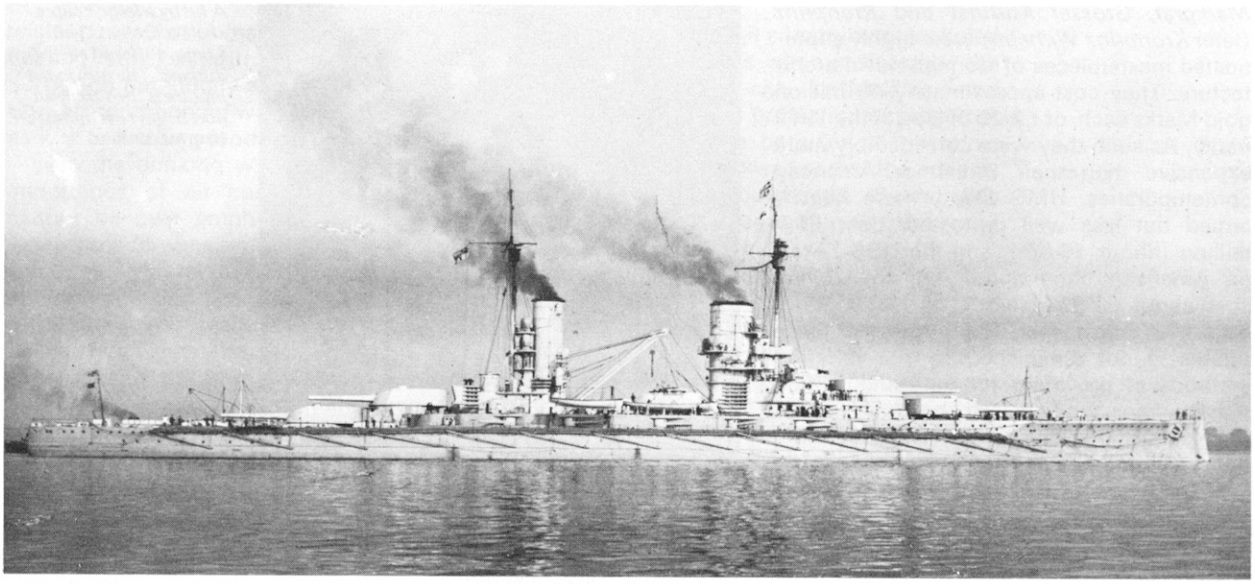
Publishers Notice

Earlier this year we announced that the Warship Profiles would in future contain additional pages so that the colour drawings would increase in size. We also refrained from raising the price due to the government's price restraint.
With additional heavy cost increases in production, we have no choice but to increase the recommended retail selling price of the series in the UK to 60p each.
So many readers have indicated that they appreciate the high quality standards achieved to date, that we have concluded that to reduce quality to compensate for rising costs is not what our readers require of us.
The new price structure becomes operative as from 1 August 1973.



Your Next Profile
No 38 Abdiel-Class Minelayers

This is the story of the fast minelayers which ran supplies to Malta during World War II. They were the fastest surface ships in the Royal Navy, but this Profile reveals the truth about their performance. Written by Tom Burton.



KÖNIG Class Battleships

by Tobias R. Philbin, 3rd, B.A.

Germany and the High Seas Fleet

From the time of Germany's unification until the demise of the Second Reich in military defeat and revolution in 1918 there was a constant search for symbols of German unity.

In the Naval establishment created by Grand Admiral Alfred von Tirpitz and Kaiser Wilhelm II, such a symbol was found. As an instrument of policy whose purpose was to compel even the greatest naval power of the time to consider an attack on Germany an untakeable risk, the Imperial German Navy failed in its purpose but produced some remarkable examples of naval architecture as the fruit of the first modern arms race.

The German Navy was set up under statutes whereby it received a certain number of ships at a steady rate each year. The Reichstag, or German Imperial Parliament, retained control of the appropriations but could not review the laws. In the end there were not enough ships to defeat the Royal Navy in open battle, but there were enough to make the British consider the interests of the United Kingdom in danger.

The battleship *König* was included in the 1911 German construction programme, along with her sisterships *Markgraf* and *Grosser Kurfürst,* and the battle cruiser *Derfflinger.* As a German capital ship built in that year, she represented the penultimate of the first generation German dreadnought battleships. The *König,* as the flagship of Rear-Admiral Paul Behncke, led the German battlefleet into the Battle of Jutland.

The Evolution of the Konig Class

The *König* class was the fourth class of Imperial German Navy dreadnought. They represented a line of warship development begun with the *Nassau* class of four ships, 18,900 tons displacement, armed with twelve 11in guns in six twin turrets. These ships were followed by the *Helgoland* class of four ships, 22,800 tons displacement, armed with twelve 12in guns in the same manner as the *Nassaus.* The third class of German dreadnought battleship was the *Kaiser* class of five ships armed with ten 12in guns in five twin turrets .They displaced 24,700 tons, and had the first superfiring turrets in German battleship design, with an *en echelon* arrangement amidships. The *König* class was next with four ships of 25,390 tons displacement and ten 12in guns in five twin turrets, all on the centre line, and two superfiring fore and aft. After the *König* class the only other German dreadnoughts to enter service before 1918 were the *Baden* and *Bayern,* 28,000 tons desplacement and armed with eight 15in guns each. SMS *König,*

SMS König *in her first guise in 1914. Torpedo nets are shipped and her light pole masts are still stepped. Note wireless spreaders on foremast.* (Bundesarchiv)

Markgraf, Grosser Kürfurst and *Kronprinz* (later *Kronprinz Wilhelm*) were highly sophisticated masterpieces of German naval architecture. They cost approximately 45 million gold Marks each, or £2·25 million at the 1912 parity. As such they were considerably more expensive than their British or American contemporaries. HMS *Orion,* more heavily armed but less well protected, cost £1·7 million (about $6·8m), and the USS *Texas,* an American contemporary of the *König,* cost about £1·35 million ($8·1), or about 60% of *König*'s cost. The import of these figures is not diminished by the differing methods of providing for outfitting, which the Germans worked into the total cost of their ships. This will be explained in more detail later. The significance of these costs is that the equipment which went into the German battleships of the time represented the limits of the technology of the time, much in the same way that space technology does today.

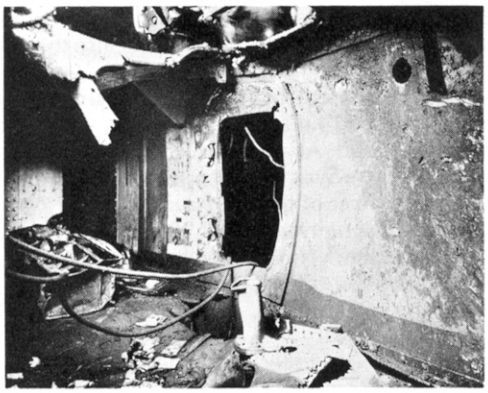
In all German warships of the Tirpitz era there were some design features which were the result of standard regulations, which should be explained. These concerned the *König* class in the following areas: accommodation, armour protection, cost, displacement and damage control.

Accommodation

As a squadron flagship, SMS *König* carried a Rear-Admiral and a Squadron staff at all times. She had, consequently, an Admiral's bridge and sea cabin which the other ships in the class did not. Her captain had to share his reception and dining room with the Admiral and his staff. The Captain of the *König* otherwise had a day cabin and a sea cabin just off the bridge, a bathroom and a closet. The Admiral, of course, had his own cabin in addition.

SMS *König*'s crew slept in hammocks, each man having a locker for clothes and a locker for boots, with a small number of extra lockers available. These lockers were of galvanized metal and fitted into the sides of the ship. In giving men lockers of their own, the German Navy was well ahead of its foreign contemporaries, as this was not common practice in British or American navies until the latter part of the Second World War. The importance to morale of each man having a place which was his own was and is substantial. These careful arrangements were upset by the mobilisation plans which had increased the complements of the ships by as much as one third, thus resulting in severe crowding, and all its concomitant ills. In addition to the lockers carried for sailors, stokers' lockers for dirty clothes were carried for the established number in the engineering department.

A hit by a large calibre shell at Frame 93 on König, *suffered at Jutland. The gun in the picture is the foremost port 5·9in casemate gun.* (Bundesarchiv)



SMS König *hit under deck. The sign in the picture indicates a ventilator extending from frame 92½ to 103, an area which housed ammunition and secondary steering positions. Jutland 1916.* (Bundesarchiv)

Another view of a hit below decks. The armoured bulkhead door has been completely ripped from its moorings by blast and the hit was caused by a heavy projectile, probably 15in. (Bundesarchiv)

Every space in the ship had to be adequately lighted and ventilated. The ship was heated with steam from the main boilers, and the regulations provided that the temperature in Flag officers', Captains', department heads', cabins as well as the messes, offices and sickbay and bathrooms could be raised to 59° Fahrenheit. The cabins of the other officers, mess decks, chart house, and pantries to 50°F; engine rooms, boiler rooms, torpedo flats, passages and heads to 41°F. This contrasts with the English, who

wishing to feel at home, did not instal central heating in their ships until a much later period.

Though not strictly a part of accommodation, air conditioning was used for magazines as well as keeping food and perishables fresh —even the drinking water was cooled. The importance of air conditioned magazines cannot be over emphasized: in the days when powder was notoriously unstable the Germans lost not a single capital ship to internal explosion.

Furniture was made exclusively of steel because it was non inflammable. The remainder of the ship's officers were well provided for, though no more than their contemporaries in other navies. The sub-lieutenants were two to a cabin, and officers more senior generally had a cabin apeice, in the large ships.

Washing facilities provided were extensive, and the object was to provide one shower for every three men. Sick bays, dispensaries, dressing stations, were all provided as well as clothes drying rooms and cells for prisoners. These could not be near the engine rooms and had to be well ventilated.

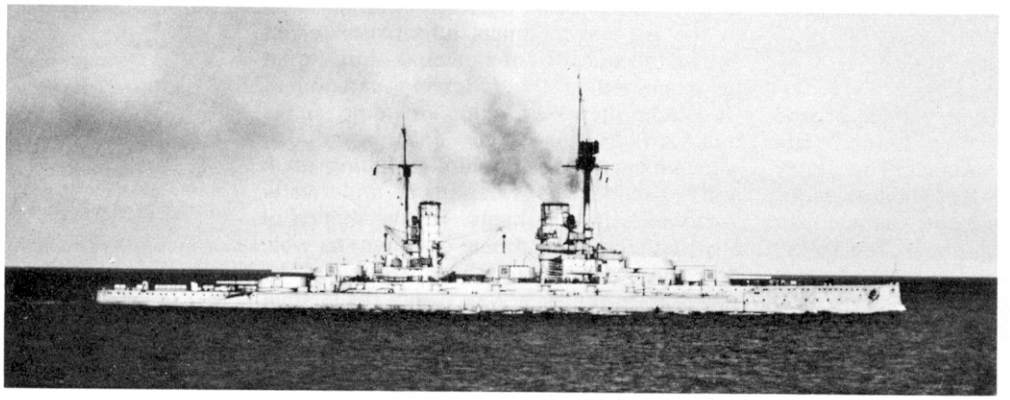
Armour

As in other modern German dreadnoughts, *König* and her sisters were armoured in citadel fashion. In considering the weight of armour, German naval constructors included the side armour, the armour backing, the bolts, protected decks, cofferdams, and filling. The system of protection consisted of a caisson extending between the extreme fore and aft turrets, closed across the ends by vertical armoured bulkheads. Byond this citadel, the armour was continued to bow and stern, though not as thick.

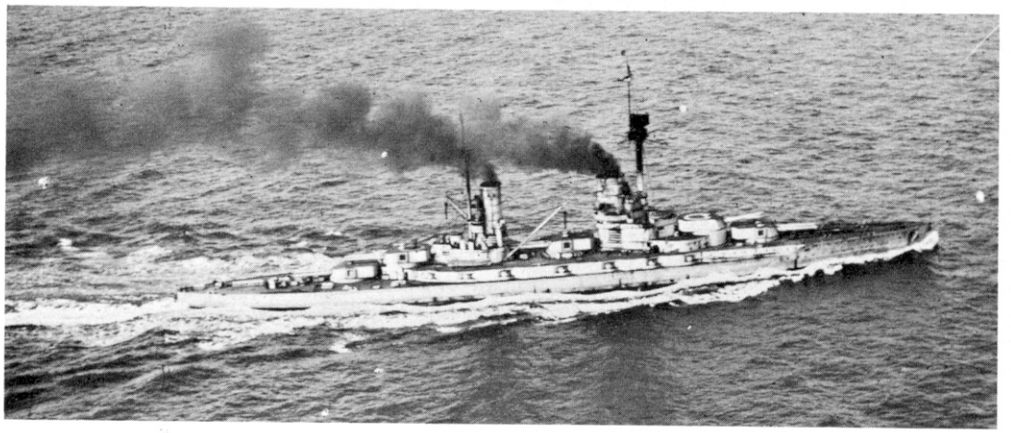
Underwater protection also consisted of a closed caisson, the same length as the principal armoured belt. This was developed from the *Nassau* type, in which a single longitudinal bulkhead was placed about 6ft 7in inboard of the inner skin of the ship on each side, rising from the double bottom. In the *König* class, which evolved from the three earlier classes, an additional internal anti-torpedo bulkhead was placed as far again inboard of the first bulkhead. The intervening space was filled with coal.

Cost

The Imperial Navy Office under Grand Admiral von Tirpitz subdivided the cost of new ships like *König* under three headings: shipbuilding, gun armament, and torpedo armament. The shipbuilding included the cost of machinery and trials, while the gun armament included the cost of reserve ammunition, guns and mountings.



SMS König *after August 1917 refit with heavy foremast and new wireless aerials; torpedo nets removed, rafts on turrets, splintershields around bridgework.* (*Bundesarchiv*)



Another view of König *showing aircraft recognition circles painted on No 2 and 4 turrets.* (Bundesarchiv)

Construction funds were voted in annual instalments with battleships and large cruisers taking four instalments each. This accounts for the relatively slow building of the German fleet, even in wartime, as it is apparent the instalments were not hurried. The actual money spent was not published. The Reichstag simply voted yes or no for the ship's next instalment. The politics behind all this were managed by Tirpitz, who as a Minister of State sat in the Reichstag with full powers in addition to being Chief of the Imperial Naval Office.

The *König*, like her sisters was paid for in four instalments as follows:

Payment	Hull and Machinery	Gun Armaments	Torpedoes	Total
1st	£269,080	£195,695	£14,677	£479,452
2nd	£513,699	£232,387	£21,526	£747,612
3rd	£440,313	£256,849	£14,188	£711,350
4th	£244,619	£196,184	£16,634	£457,437
Totals	£1,467,711	£881,115	£67,025	£2,415,851[1]

[1]As a rough guide, at the time £1 = $4.00

Displacement

The German Navy List or *Rangliste der Kaiserliche Marine,* was the official tabulator of all German naval vessels, and the measure used was the metric ton, or one metric ton = ·984 English tons. This was the ship's construction displacement or the amount given when the ship had all her stores and authorised equipment aboard, or when she was floating to the level of the constructor's designed waterline, or CWL.

Damage Control

No analysis of the *König* class or the Imperial German Navy could be complete without examining this subject. The ability to absorb great quantities of shell-torpedo-damage before sinking made the German fleet units extraordinarily robust. The key to this system was a powerful pumping system combined with the armour.

Every ship was furnished with a drainage diagram, which illustrated the drainage arrangements of the ship, the drainage valves in each compartment, and their location as well as how to work them. All frames and compartments were clearly labelled and could be found on the diagram. This was to facilitate finding any pump quickly. The German navy also assigned an officer, usually the second-in-command to control the ship's damage and flooding in battle. The flooding system was built so that all magazine spaces in a compartment or next to its bulkheads could be flooded at the same time. It took 15 minutes to fill any magazine on the *König* deck to the deckhead with water. The basic means of flooding magazines was seacocks, with a common flooding main as backup. This was connected to the circulating pumps and reserve feed pumps. It was impossible, however, to flood the magazines entirely by the seacocks so the combined system was used.

Every year there was a flooding exercise in all ships designed to take flooding. It included the actual filling of a few compartments of the double bottom using compartments or passages on one side of the ship, and counterflooding on the other side. This allowed her crew to gain experience in steaming and fighting a damaged ship. Such practices paid high dividends at Jutland.

As a final note, torpedo nets were re-introduced in German dreadnoughts and retained until after the Battle of Jutland, when it was felt that the speed of eight knots at which they could be used under way was wholly inadequate for fleet operations. Also the nets were dangerous when rolled up, as they could easily foul the ship's screws if damaged.

The König Class

Any class of ships may be understood in terms of some basic parameters. In addition to the general technical information given above, the specifics of a given design should be examined in the following categories: Construction of the ship, including ship's hull, armour, machinery and propulsion; also armament of the ship, including main and secondary weapons, underwater weapons; ship's sensors. The aesthetics of any particular design bear comment as well, and the *König*s have been described by Richard Hough in a way which befits their station, 'Their appearance, with tall twin funnels hugging the masts, and a long sweeping forecastle extending back to the aft superimposed turret was a great deal more dignified than that of earlier German dreadnoughts.'

König Class Construction

SMS *König*, designated 'S' in the 1911 construction programme was built at the Imperial Dockyard, Wilhelmshaven. Of her sisters, *Grosser Kurfürst,* known before launching as the 'Ersatz *Kurfürst Friedrich Wilhelm*' or replacement for *K. F. Wilhelm,* was built at the Vulcan Works, Hamburg; *Markgraf,* the 'Ersatz *Weissenburg*' was built at the Weser AG yard in Bremen and *Kronprinz,* later the *Kronprinz Wilhelm* from June 1918, was built as the 'Ersatz *Brandenburg*' at Krupp's Germania works in Kiel.

A photograph of a shell impact which came at an oblique angle across the deck and then plunged through the teak and steel deck into the anchor-windlass room. It was probably a 15in shell fired by HMS Warspite *at* König *at Windy corner.* (Bundesarchiv)

Another view of the same shell hole, this time from forward. The damage was substantial. The photo reveals the built-up manufacture of German naval ordnance. The König *is moored at Kiel with her anchor cables removed.* (Bundesarchiv)

The damage done to the anchor windlass can be plainly seen in this photograph. A hawse-pipe is stove in, stanchions bent, gear damaged and the deck overhead completely wrecked. (Bundesarchiv)

The next sections deal with the general dimensions of the *König*. To assure completeness of the information the statistics are given in both official German and British measures. The British statistics come from the archives left by the Naval Intelligence Division of the 1914-18 British Admiralty war staff. The German information comes from a series of ship's technical manuals, *Deutsche Kriegsflotte,* which have survived in the hands of the Federal Military Archives, in Freiburg.

In English measure the general dimensions of the *König* Class were :

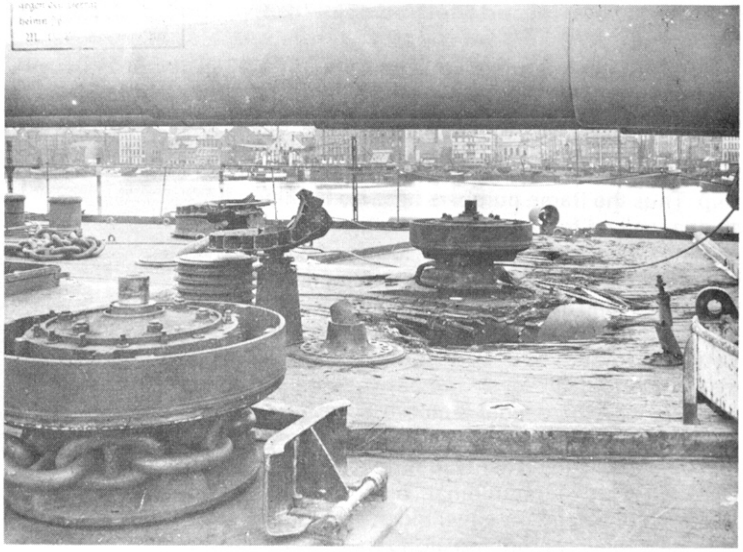
Length, extreme :	575ft 9in	
Length, load water line	573ft 2in	
Breadth, extreme :	96ft 9in	
Designed load draught :	27ft 3in	
Designed load displacement :	25,390 tons	
Approximate freeboard at stem :	22ft 0in	
Approximate freeboard amidships :	9ft 6in	
Approximate freeboard aft :	13ft 0in	
Approximate height of axis of heavy guns at designed draught :	No. 1 turret :	26ft
	No. 2 turret	35ft
	No. 3 and 4 Turret :	27ft
	No. 5 turret :	19ft
Approximate height of sighting slits of fore part of conning tower :		42ft
Height of fore funnel to load water line :		78ft
Height of lower mast to load waterline :	100ft	
Depth from keel to battery deck :	39ft 11½in	

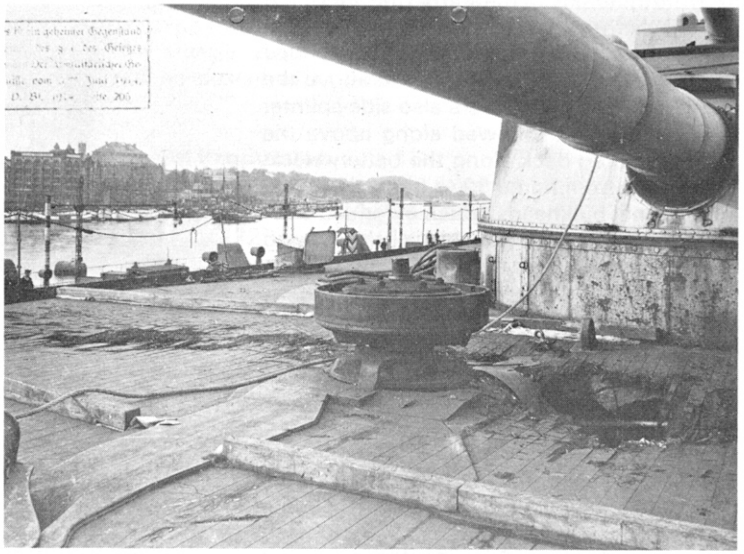
In German measure *König*'s general dimensions were :

Displacement as built, weight in registered tons :	25,796 tonnes
(a) following the German ships egistry regulations	
	loaded 14,839 tonnes
	empty 6044 tonnes
(b) following the regulations for transit through the Suez canal from the Donau agreement :	loaded 14,360 tonnes
	empty 8475 tonnes
Length between perpendiculars :	174·70 metres
Length from the after part of the stern gallery to the figurehead platform :	174·40 metres
Length along the constructor's water line :	175·70 metres
Beam, extreme as built :	29·50 metres
Maximum beam for decks and platforms :	30·00 metres
Draught forward :	8·33 metres
Draught aft :	8·33 metres
Weight of provisions and material :	230·34 tonnes
Weight of drinking water :	76·72 tonnes
Freshwater in the double bottom :	174·92 tonnes
Coal bunkerage :	850·00 tonnes
Full load coal bunkerage :	3600·00 tonnes
Oil bunkerage, full load :	700·00 tonnes

To submerge the *König*s one cm required 36 tons additional displacement, if the seawater had a specific gravity of 1·015 grams.

The *König* class's metacentre was 2·59 metres in height and 203 metres long. Maximum stability was achieved in a 28° roll, and capsizing took place if the ship rolled more than 62° off her centre line.





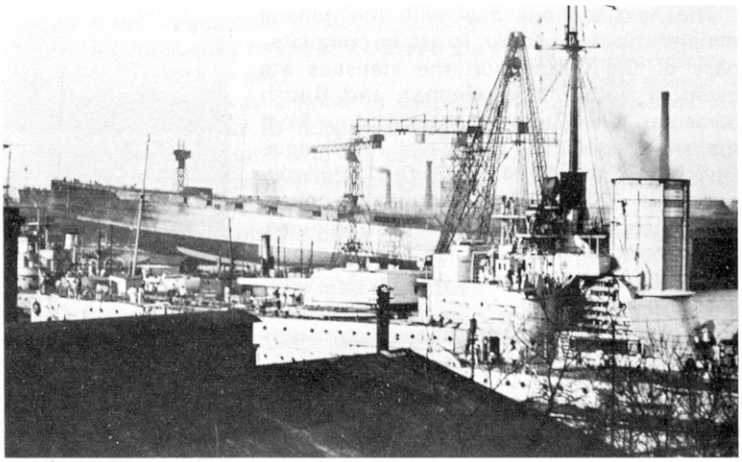
Building Material and Method of Construction

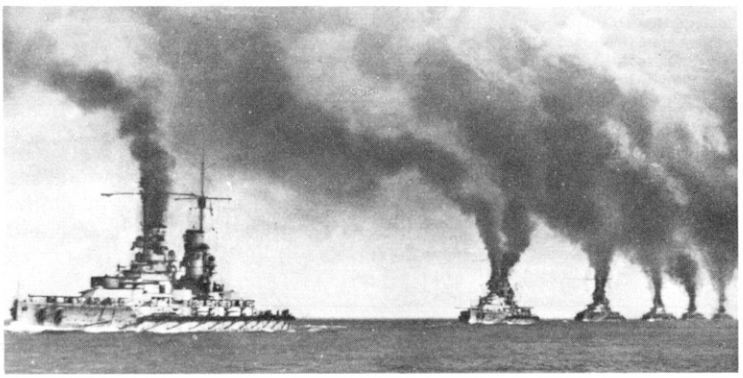
The *König* and her sisters were built of Siemens-Martin mild steel, made by the open hearth process. The Imperial German Navy numbered the frames in their ships consecutively, starting from the stern of the ship. Thus the frame numbers became higher as one walked forward. The watertight inner body of the ship extended longitudinally from frame 35 to 137 and transversely from frame 120 and rose to the eighth platform between the aforementioned frame limits. Between frames 120 and 126 the citadel rose to platform six level, and between frame 127 and 137 the citadel armour came up to the lower platform deck. Sixteen watertight bulkheads divided the ship into 17 main compartments. Longitudinal bulkheads in *König* were placed on either side of the ship with passageways running along them rising from the inner skin of the ship to the armoured deck. On either side of the ship there was also a parallel armoured bulkhead that extended from the ship's bottom to 1 metre above the armoured deck. There were also side splinter bulkheads which followed along above the main armoured deck along the battery deck. There were from frame 30 to frame 113, two longitudinal bulkheads which extended from the outer bottom of the ship all the way to the battery deck.

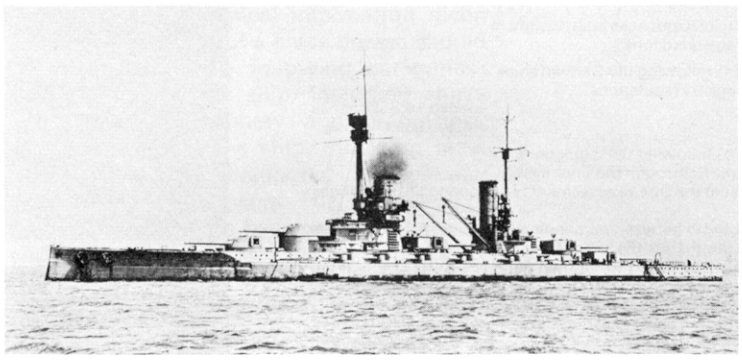
Between the battery deck and the superstructure there were longitudinal splinter bulkheads. The various passageways around the armoured deck were on the outside of these.

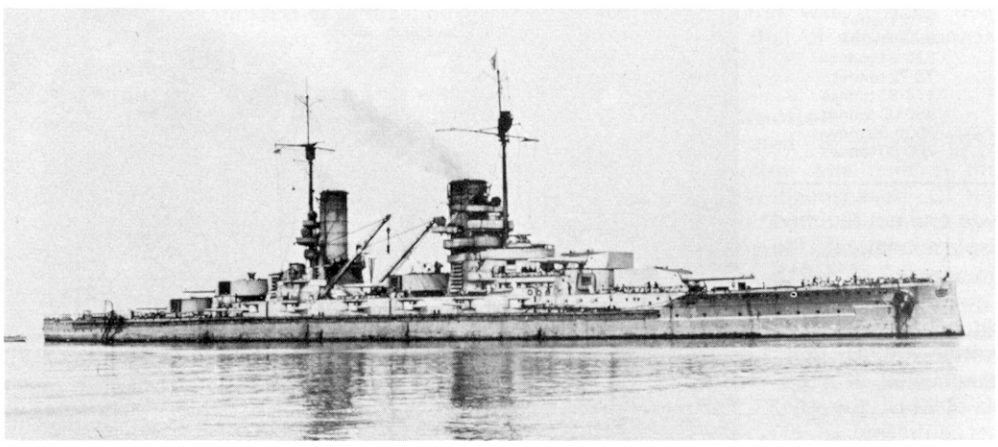
Fuel Supply

The *König* class bunkered both coal and oil, the oil being stowed in the ship's double bottom. The feed coal bunkers were located from frame 30 to 113, under the armoured deck. Outer, reserve coal bunkers lying outside the armoured deck were located between frames 45 to 83½.









Another shot of König *after her reconstruction in 1917.* (Drüppel)

SMS König *in her first guise, after torpedo nets had been removed but before the new foremast had been stepped. She is still a Vice-Admiral's flagship.* (Drüppel)

Ship's Decks

The *König* class was built with the following decks, in order from the keel up: the lower platform deck, the upper platform deck, armoured deck, middle deck, battery deck, weather deck, and superstructure decks. The decks were plated with steel and covered with linoleum, with the exception of the weather decks, which were covered with a 65mm thick planking of teak. Mahogany planking was laid beneath the anchor chains.

Armour

König class armour was a low carbon content Krupp alloy steel, called Ridel steel.

The armoured deck, which lay from frame five to nine at a level of 500mm above the CWL; from frame 11 to 113 at a level of 200mm above the CWL: and from frame 113 to the bow at a level of 1350mm below the CWL varied in thickness from 60 to 120mm. The main belt of side armour extended from the after torpedo bulkhead to the forward torpedo bulkhead, and to a depth of 15ft below the waterline. The outer part of the armoured belt extended 1350mm below the CWL. This was, of course closed at frame five by an inclined deck which went to the stern. The thickness of the armoured deck from frame 5-11 over the rudder housing was 120mm; from frame 11-21 100mm; from 21-31 60mm; from frame 30-113 30mm; and from 113 to the bows 60mm.

The battery deck, or that supporting the casemated secondary armament extended fore and aft behind the casemates and the plating was 30mm thick. The superstructure deck was 30mm thick in the areas over the casemates. The following table should aid in understanding the armour distribution of the *König* class:

Contrary to previously held information, the transverse and fore and aft bulkheads were pierced. But all important bulkheads were actually tested with up to 30ft of water behind them. Statistics for the armour of the *König* class were: Citadel:

Main armour belt—approximately 14in thick amidships tapering to the lower edge, about 12ft wide with 5ft 7in below the constructor's water line.

Upper armour belt—approximately 10in thick, with a width of 6ft 10in.

Transverse bulkheads—approximately 10in thick, one on each end of the main armour belt, closing the citadel. There was also a 10in thick bulkhead about 20ft from the stern, to protect the rudder machinery.

Belt beyond the citadel—fore and aft about 6in thick.

Battery—7·9in thick walls 6ft 10in high.

Deck armour—principal armoured deck from 2·4 to 3in thick, about 1ft below the load waterline, sloping down aft to lower edge of armour. The armour around the weapons systems will be described in detail in that section.

Machinery and Propulsion

SMS *König* was built with three triple stage Brown-Boveri Parsons steam turbines. These were driven by 15-227 p.s.i. low pressure naval boilers, 12 of which were coal-fired with auxiliary oil plates and three of which were entirely oil-fired. The *König*'s engines developed a total shaft horsepower of 43,300 at 251 revolutions per minute, on each shaft. Three screws, triple bladed and 3·8 metres in diameter each, propelled the ship. The starboard shaft revolved to the right and the middle and port shafts revolved to the left. At a six hour forced draught trial these engines drove the *König* at 22½ knots. The propulsion machinery was manufactured

SMS König *on the stocks at the Imperial Dockyard, Wilhelmshafen. The ship in the foreground is the battle-cruiser SMS* Von der Tann. (Drüppel)

The König *leading her class and the High Seas Fleet in line of battle, guns swung out and cleared for action, with turrets on different bearings and shells in all breeches to prevent surprise.* (Drüppel)

Side armour (side and citadel armour)			Armoured Bulkheads	
Length from frame 5 to forestays	Total Height above=+ below=− the CWL in metres	Material and armour thickness above=+ below=− in mm	Backing behind armour	Material and armour thickness above below in mm
	frame 5 to frame 30	Hardened nickel steel	not over 50mm	Hardened nickel steel
	stern armour	Frame 5 to 17		Frame 5 to 180
	+1·94 to 1·80	180		Frame 30 to 113 inside
	−1·02 to 1·70	130		the torpedo bulkhead
	frame 30 to frame 113	Frame 17 to 30		200
	(citadel)	200		300
	+3·98	350		outside the torpedo
	−1·70	Frame 30 to 113		bulkhead
	Frame 113 to the bow	200		170
	(bow armour)	350		200
	+3·22	Frame 113 to 120½		No backing was
	−3·54	200		mounted behind
	Frame 135 forward	150		armoured bulkheads
	+4·41	Frame 120½ to 135		
	−4·57	150		
	Frame 113 to 133	120		
	+1·70	120		
	−1·60	Frame 135 to forestay		
	Frame 133 forward	100		
	−2·90	120-80		

at the Royal Dockyard in Wilhelmshaven, in 1914, as were the boilers. The ship's plant could be operated on either natural or forced draught, and exhaust was vented through two funnels.

The electrical generators aboard consisted of four steam turbine dynamos which produced 225 volt current at 360kW each, and two auxiliary diesel generators which produced 300kW each.

Steering Arrangements and Manoeuverability

The *König* was manoeuvered by using one of the two main steering engines, each of which had rudder machinery attached, or an emergency steering engine which could be used to turn her twin rudders using three men and a hand crank. The rudders could be turned 35° in either direction by the main machinery, or a maximum of 10°, by hand in either direction, at a speed of no more than 8 knots. The *Königs* were reputed to be very good seaboats good in heavy weather, with a pleasant roll, and very little loss of speed in a seaway. They would only heel 8° with hard rudder at two-third speed.

Weapons Systems and Sensors

This section of the Profile includes the main and secondary armament, torpedoes, armour around the weapons systems; the fire control system; navigational systems; the ships communications and sensors.

Main Armament

The *König* class carried their main armament in five armoured turrets, each of which mounted a pair of 12in Model 1908 guns, or officially 30·5cm Drescheiben lafette C/08. This was a two gun turret, with a working chamber below the gun house and a revolving ammunition hoist leading down to the magazine and shell rooms. This was a standard model gun housing and design from the *Helgoland* class onward. Below the working chamber, there was a second revolving chamber, which contained the electric switchboards for the turret, as well as handgear for the ammunition hoists. Normally the turret would be completely electrically operated but the back up hand gear was provided for traversing the turret. The guns were hydraulically elevated, either separately or together. They originally had a range of 16,200 metres at an extreme elevation of 13½°. They could be depressed to −8°, but as a consequence of a later increase of elevation to 16°, and an increase of range to 20,400 metres, the main armament could then only be depressed to 5°. The breechblock of the 12in 50 calibre gun was a Krupp horizontal sliding wedge type, and could be worked either electrically or hydraulically. The gun could also be fired either using an electric firing mechanism or a lanyard.

To load the *König*'s main armament the guns would be brought to the horizontal position, and held there level to an indicator. The projectile and propellant would be rammed home by a hydraulic chain rammer. It was impossible to load the guns without the ramming tray being in place. As the guns were loaded, two safety flaps came up on each side of each gun to prevent the crew from being injured by recoil.

To get the projectile and propellant from the magazine to the breech of the gun, the following procedures were used.

The shells or projectiles were carried from the shell rooms to the ammunition trunk hoists on overhead rails. They were placed on a bogie in the barbette and then hoisted up the magazine trunk in the cage to the working chamber where both projectiles and cartridges were transported from the trunk hoist to the gun house hoists by means of conveyor belts (see plate II). All the hoists in the process described were electric. A block and tackle system could be used in emergency.

The projectiles were then delivered between the guns. They were followed by the propellant which weighed 273·3lbs. It was delivered outside the guns. The projectiles were then pushed by hand onto a loading tray which was lowered into line with the breech. The projectiles were then rammed home.

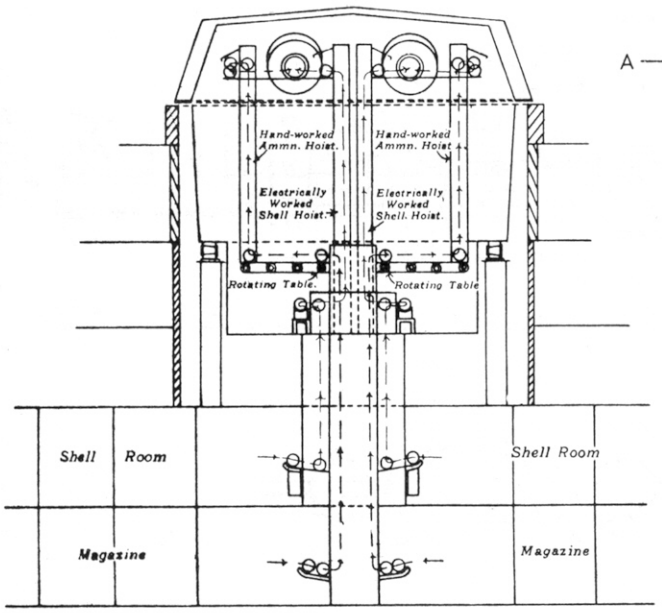
The propellant, which was encased in brass, far safer than other nations' methods of using combustible bags, was rolled from the delivery tray to an inclined trough and pushed into the breech by hand. The charge had two parts, a front charge and a main charge. The front charge was rolled into the breech by hand and the main charge rammed home. The breech was closed and the gun was now ready for firing. After firing, empty cartridge cases would be extracted and dropped through a hole in the floor of the gunhouse.

In case one hoist was knocked out, projectiles could be supplied to both guns from either hoist by an overhead rail. The projectiles for the 12in 50 calibre were 860Kg in weight in the capped armour piercing high explosive variety, or 904lb each. The muzzle velocity was approximately 2800 feet per second, and the whole operation described above could be done two-and-a-half times per minute. The arcs through which the main armament could be fired may be ascertained from the Zeichnung : the Bundesarchiv illustration provided.

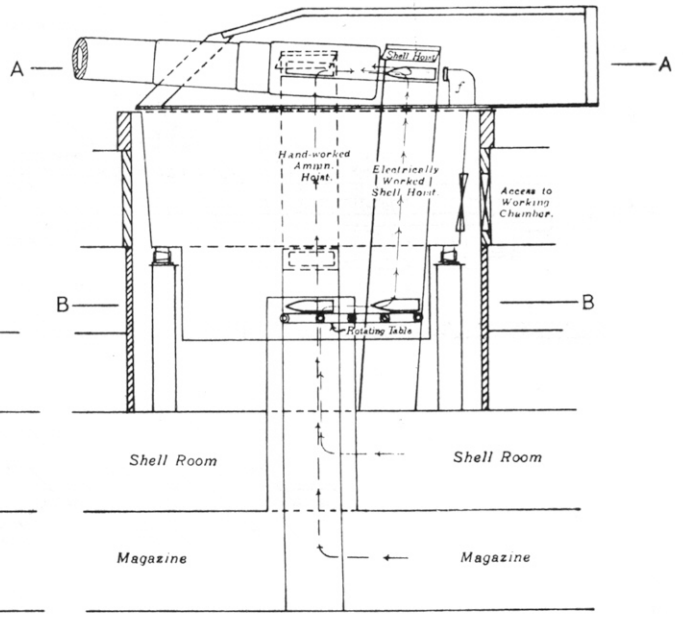
Safety was emphasized at every point in the design. The gun housing, working chamber,

A sketch by British Naval Intelligence division showing how the Königs *received their main armament ammunition.* (Ministry of Defence)

SECTIONAL ELEVATION.



ELEVATION.

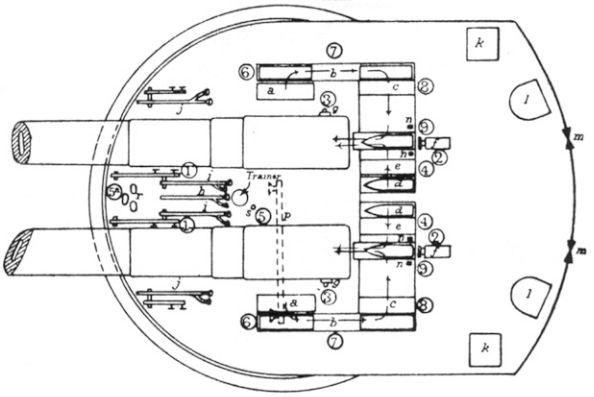


Course of Cartridge Supply. ←— — —←
Course of Projectile Supply. ←— — —←

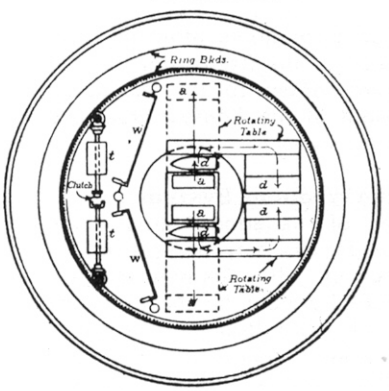
a Cartridge Hoist.
b Cartridge Tray.
c Cartridge Loading Tray.
d Projectile Hoist.
e Projectile Loading Tray.
f Hydraulic Chain Rammer.
g Breach Mechanism Motor.
h Centre Sight (Direct).
i Gunlayers' Sight (Periscopic).
j Outer Sights (Periscopic).
k Manhole.
l Cartridge Exit.
m Parts through which sub calibre gun is entered.
n Clips for holding safety flaps in place.
p Range Finder.
r Range Deflection and Order Receivers.
s Voice Pipe.
t Left and Right Training Motors.
w Hand Training Winches.

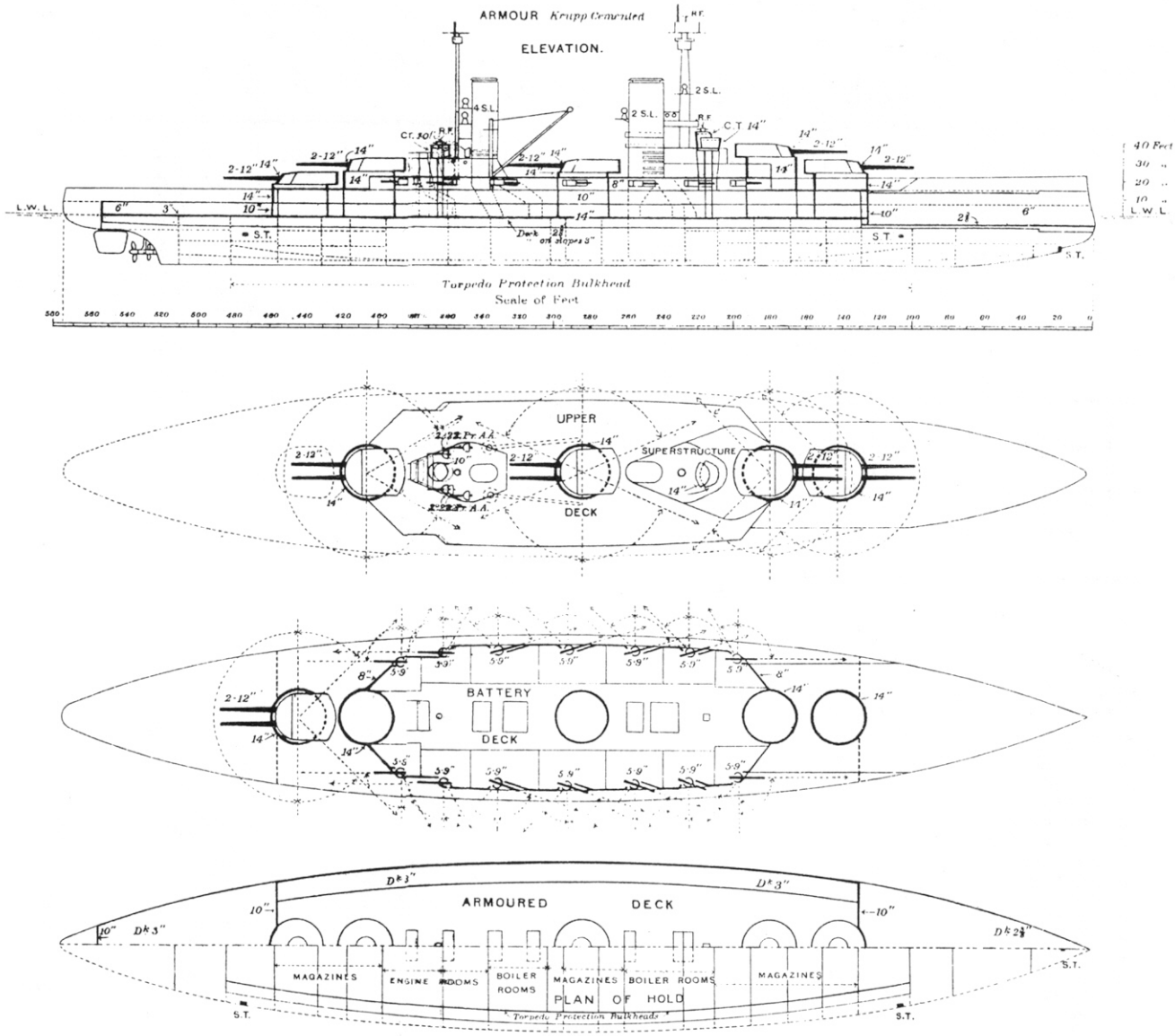
1 Gunlayer.
2 Rammer Numbers.
3 Breech Workers.
4 Projectile Cage Workers.
5 Telephone Number. Repeat all orders.
5A Sight Setter.
6 Cartridge Hoist Workers.
7 Cartridge Transporting Numbers.
8 Cartridge Loading Tray Numbers.
9 Projectile and Cartridge Loading Tray Numbers.
The Officer of the Turret is in the Sighting Hood.

PLAN at A A.



PLAN at BB.



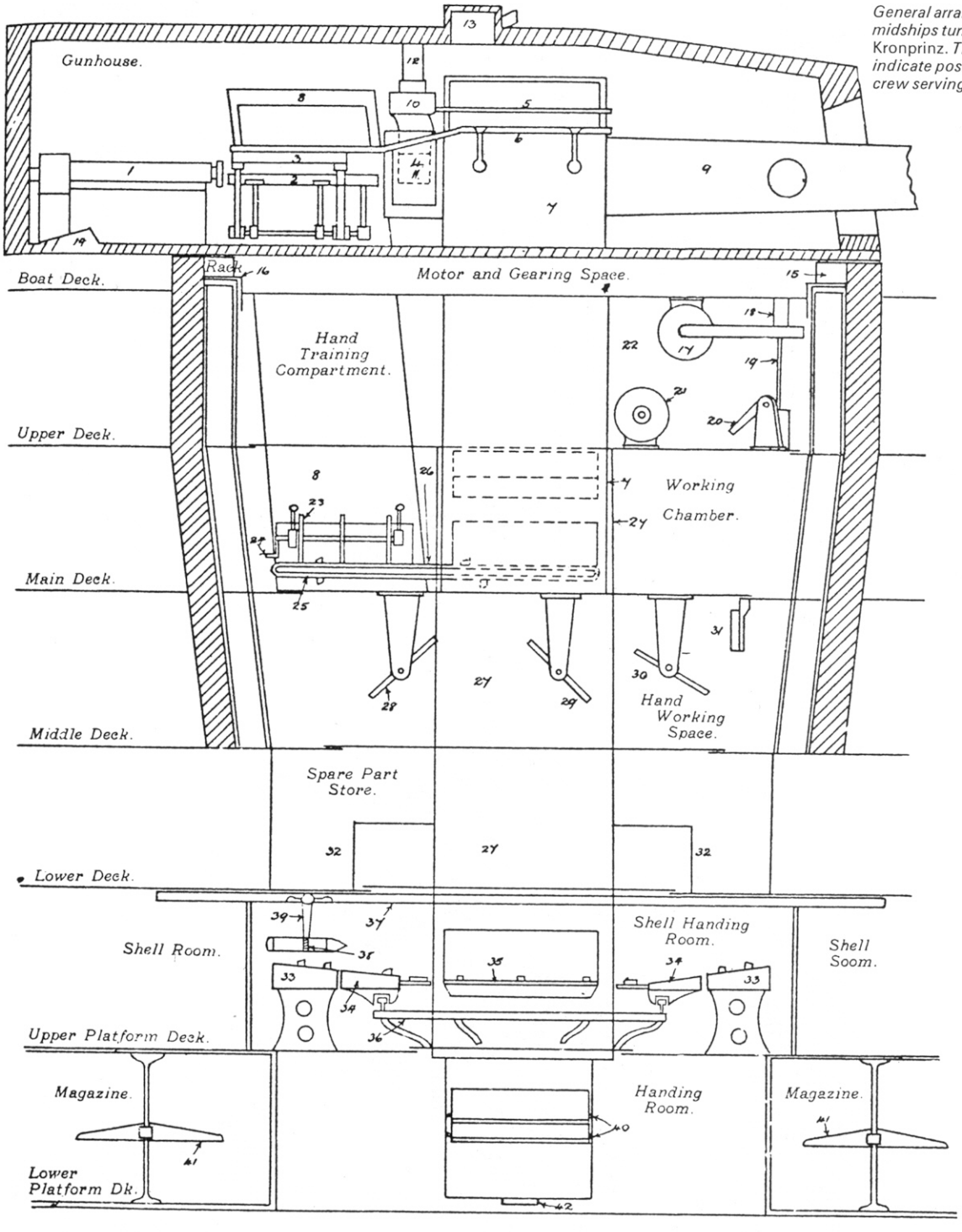


and hoists had flash doors fitted in every opening to prevent the flash from burning charges passing down to the magazine. The total weight of the *König's* broadside was 9040lb.

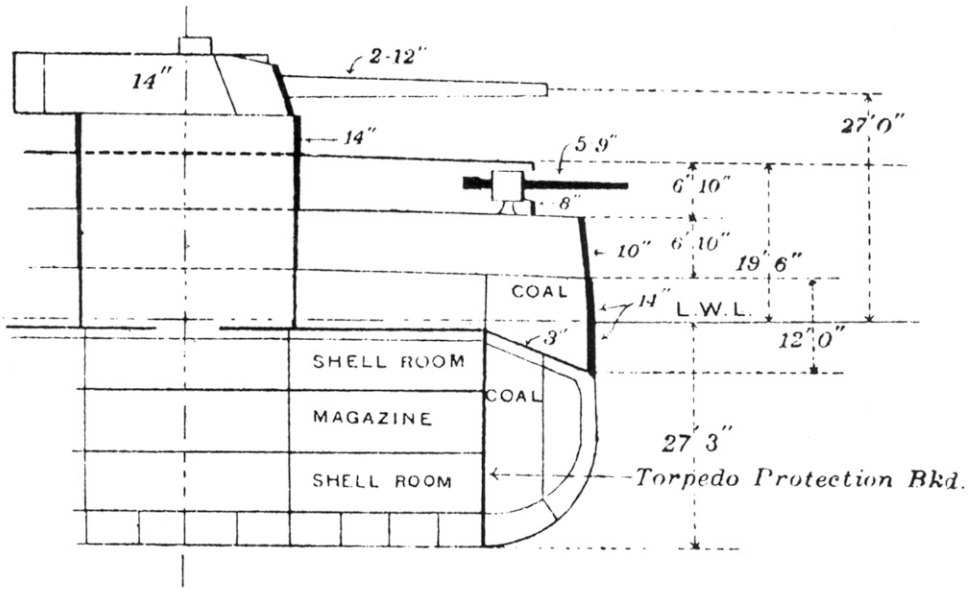
Armour of the Weapons System

An illustration of the armour around the turrets and magazines may be seen in the drawing provided. The German diagram shows the frontal armour on the turrets to be 300mm, the sides 300mm sloping to 250mm. The turrets had a 110mm roof, sloping to 80mm, and a 150mm back. The

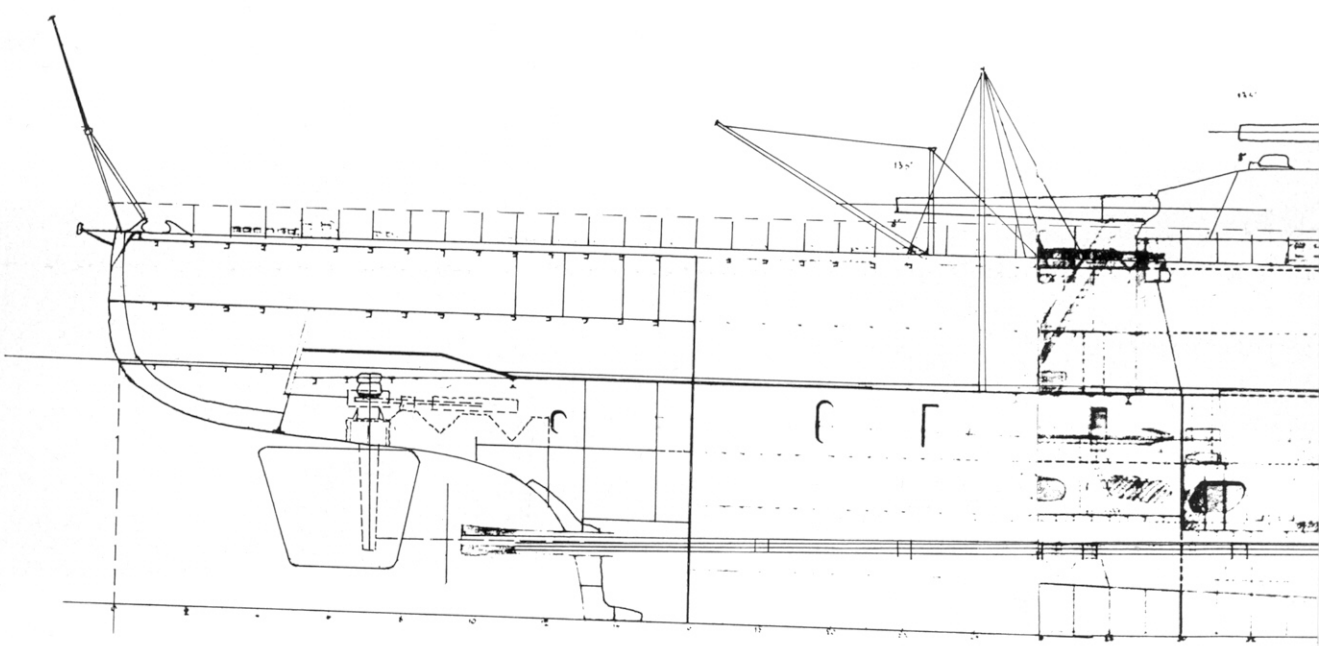
Above
October 1918 plan of SMS König *and class.* Courtesy, Naval Historical Library, Ministry of Defence, *CA 124. It includes an elevation and four plans showing the upper deck, battery deck and armoured deck midship sections. It correlates well with the German plans.*



General arrangements of midships turret of SMS Kronprinz. *The numbers indicate positions of the crew serving the turret.*



MIDSHIP SECTION



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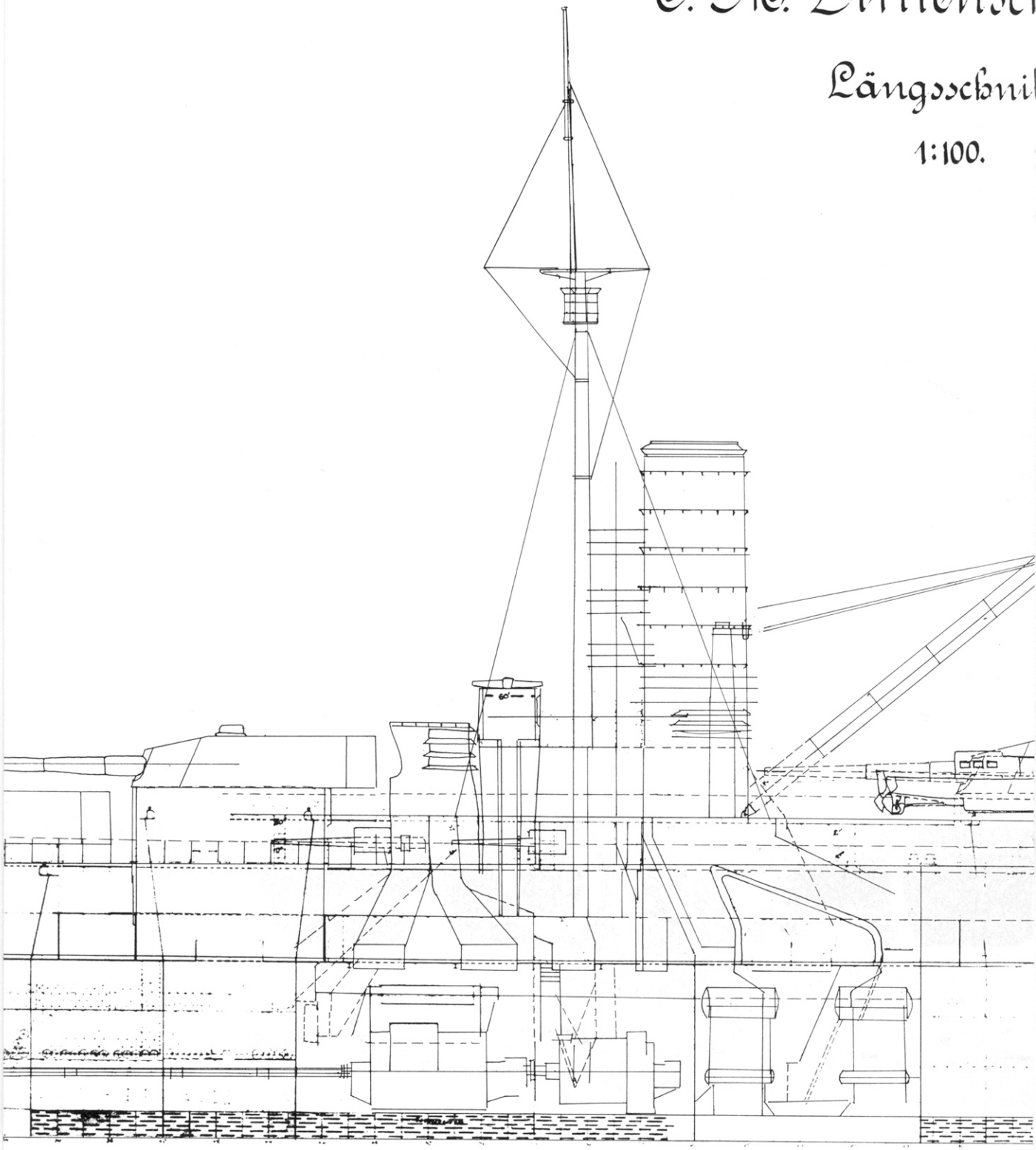

Schiff „König".

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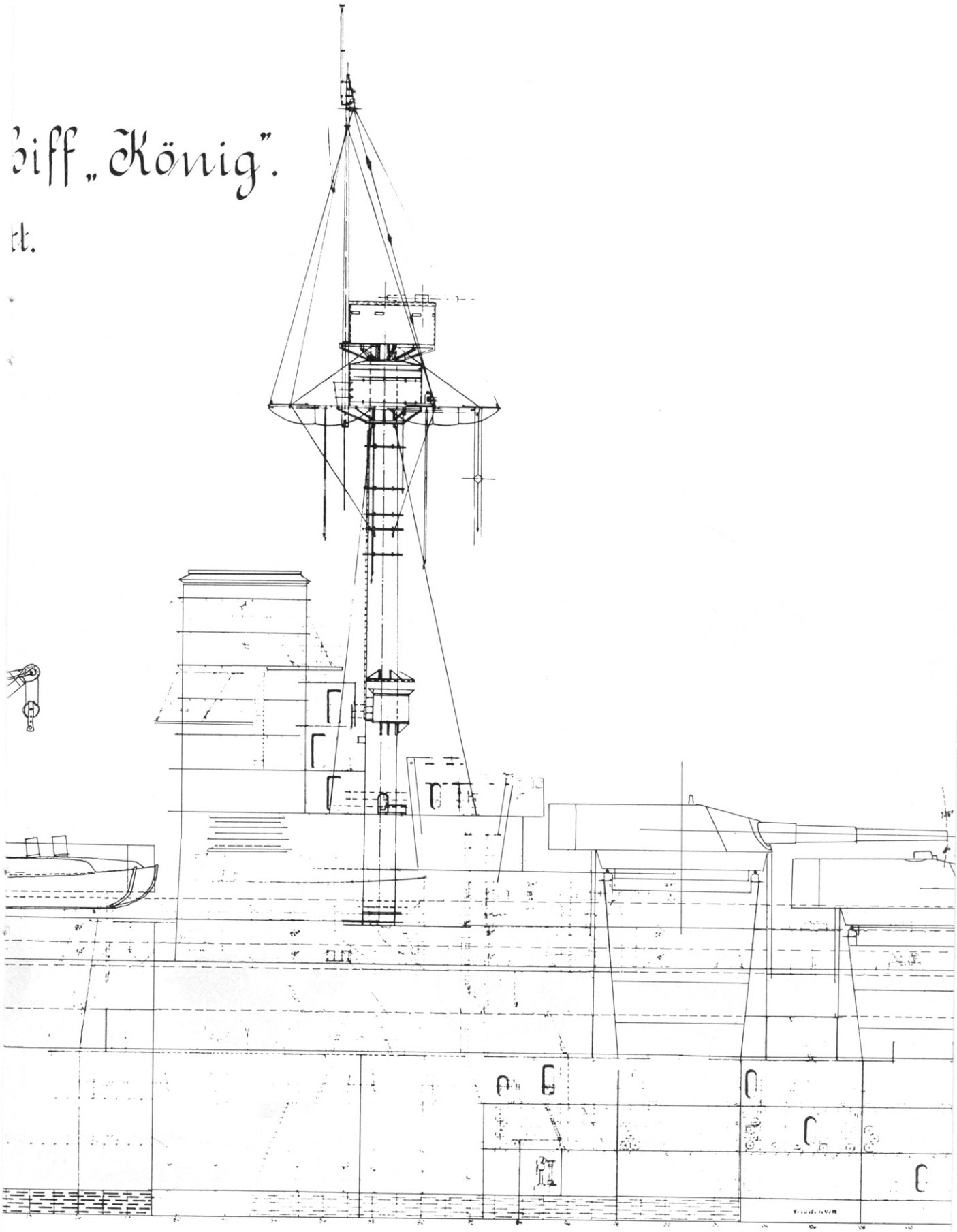
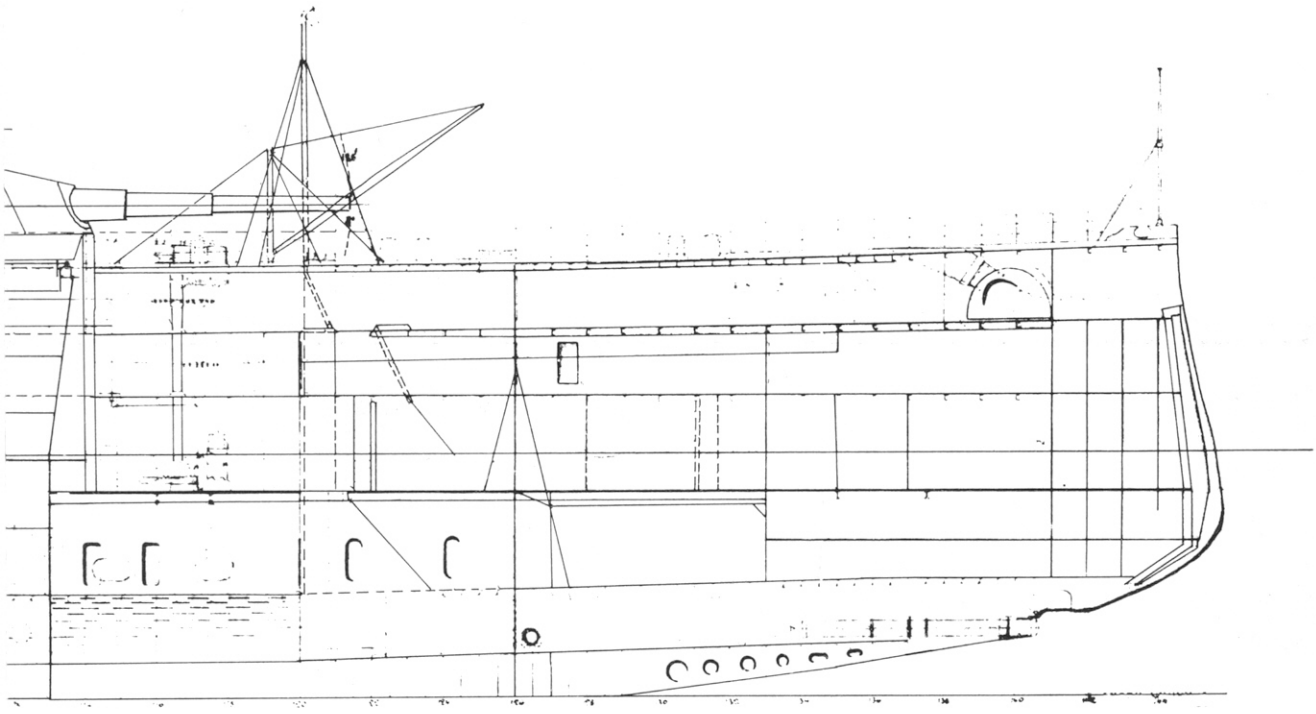
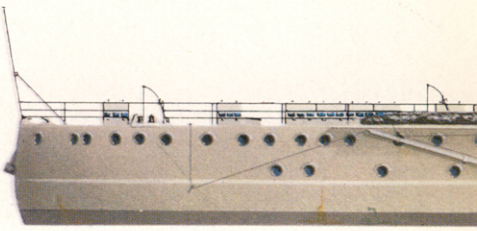


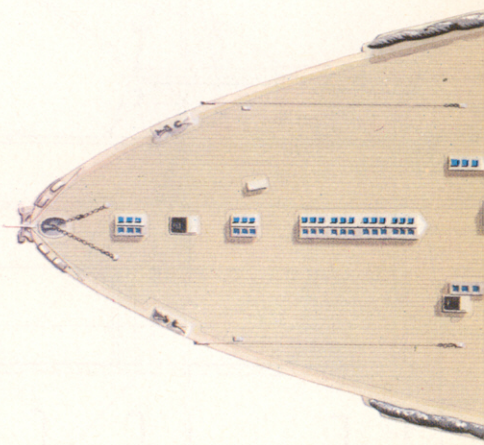
SMS König, *Längsschnitt. Profile of general arrangements. This is a cutaway starboard elevation showing internal arrangements from a broadside aspect. The numbers under the keel are the frame numbers referred to in the text. They are in increments of five. (NMM)*



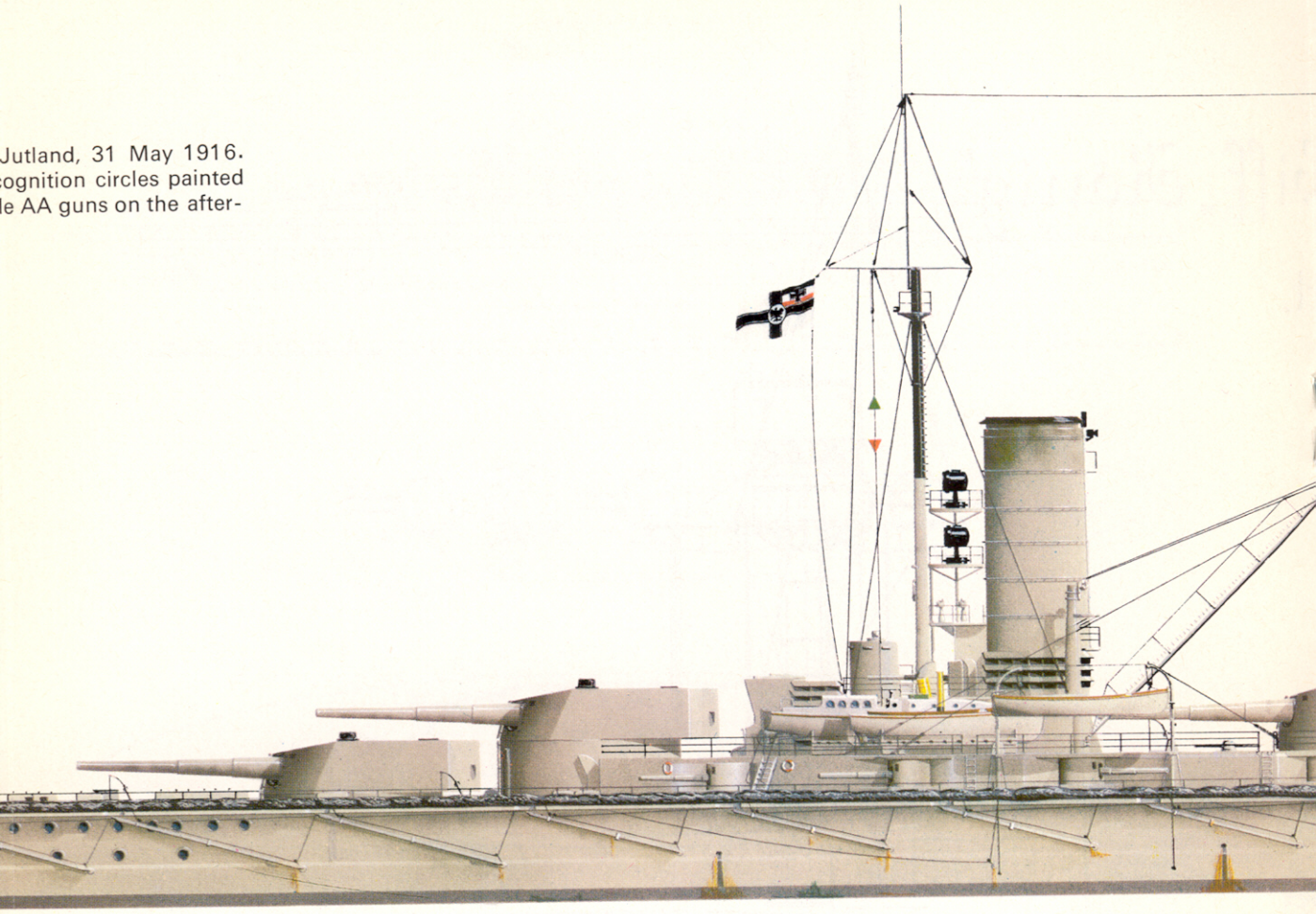
SMS *König* as she appeared at the Battle of
Note that she carried torpedo-nets and has rec
on two turrets. Note also that she has two singl
superstructure.

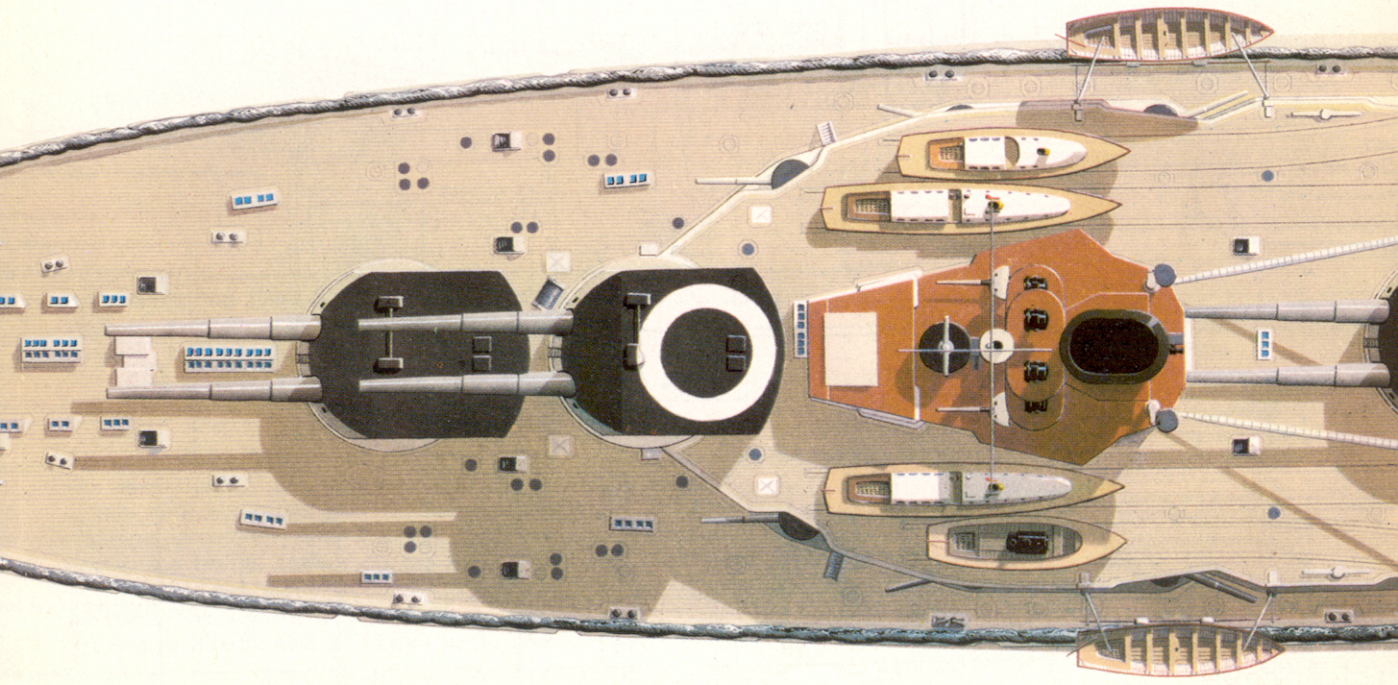
M. Holbrook © *Profile Publications Limited*

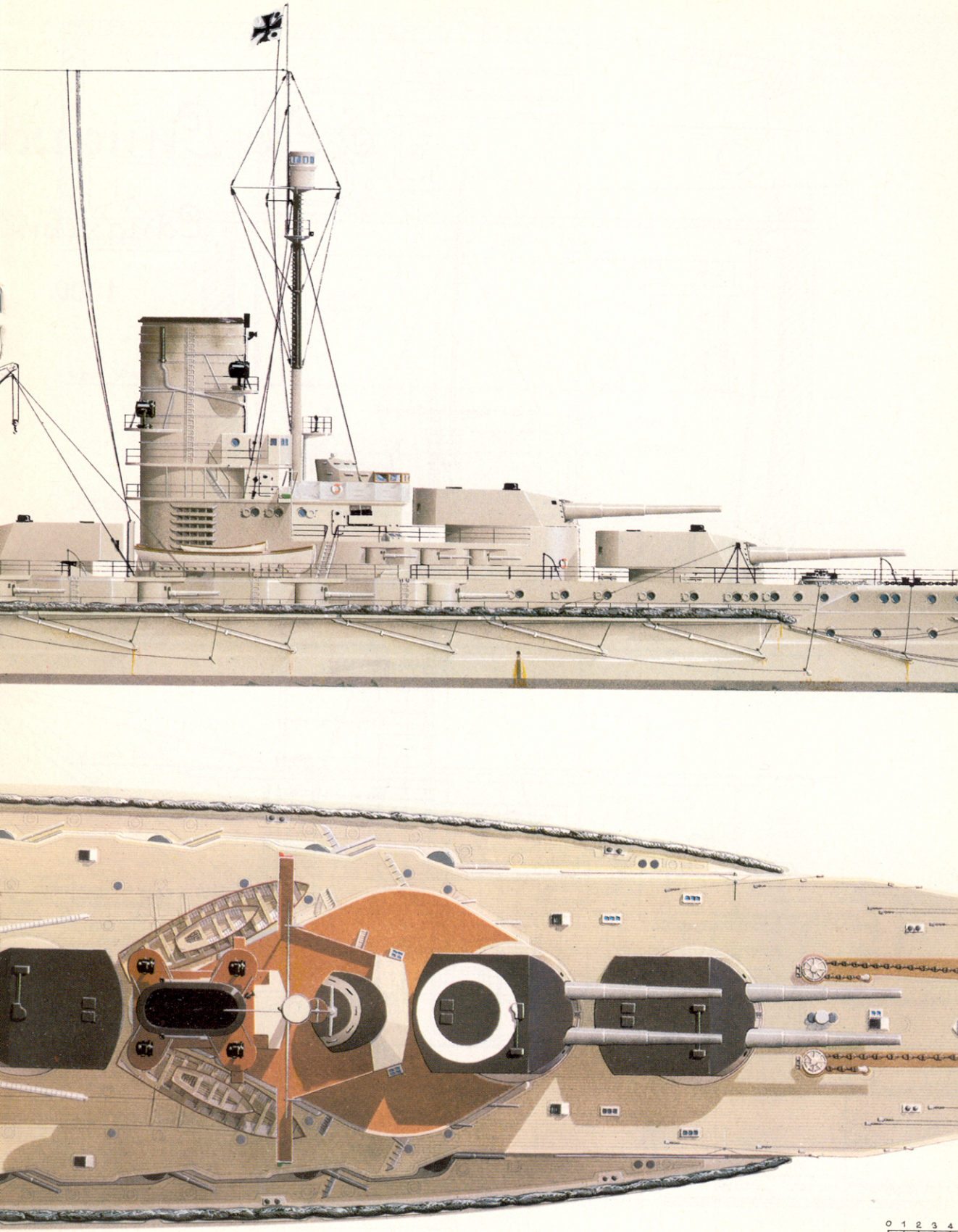




Jutland, 31 May 1916.
cognition circles painted
le AA guns on the after-



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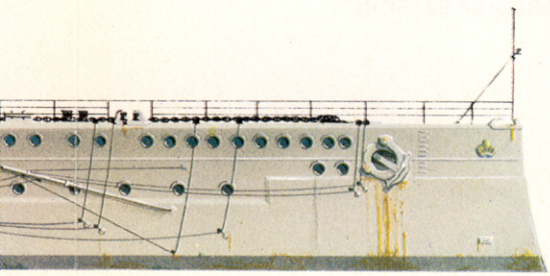
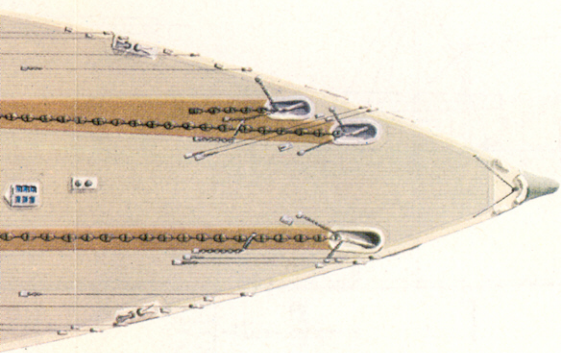
0 5 10



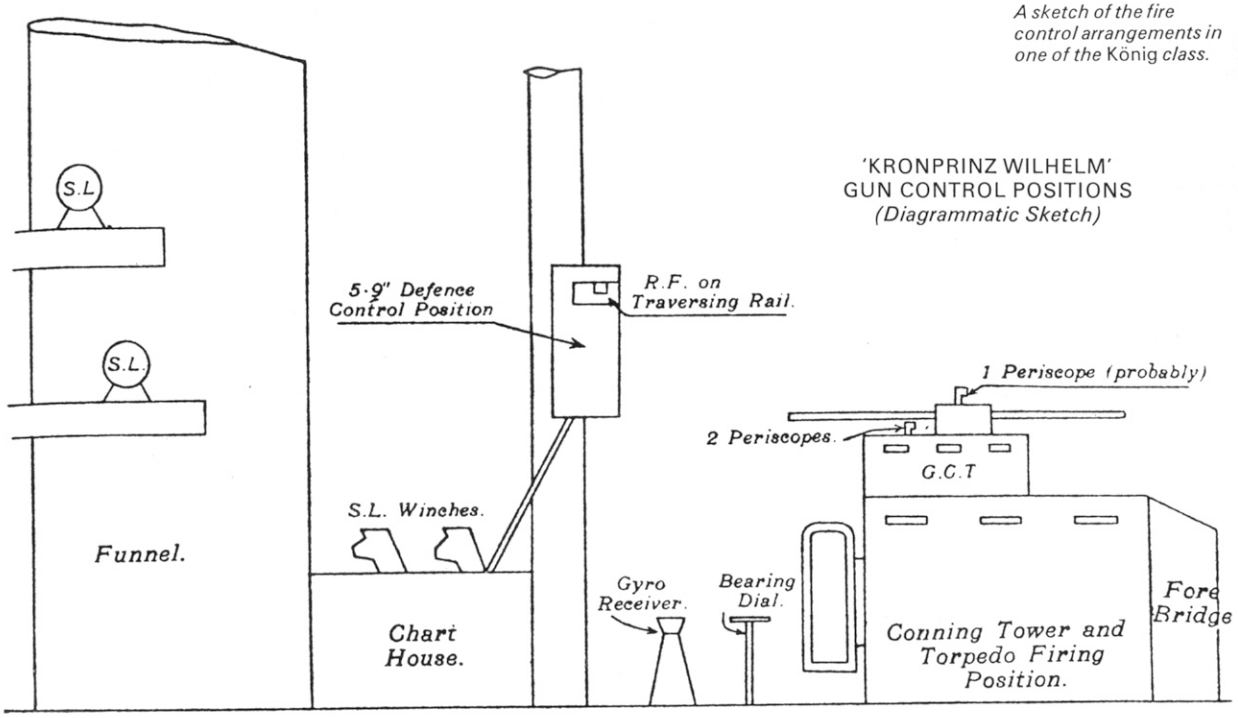


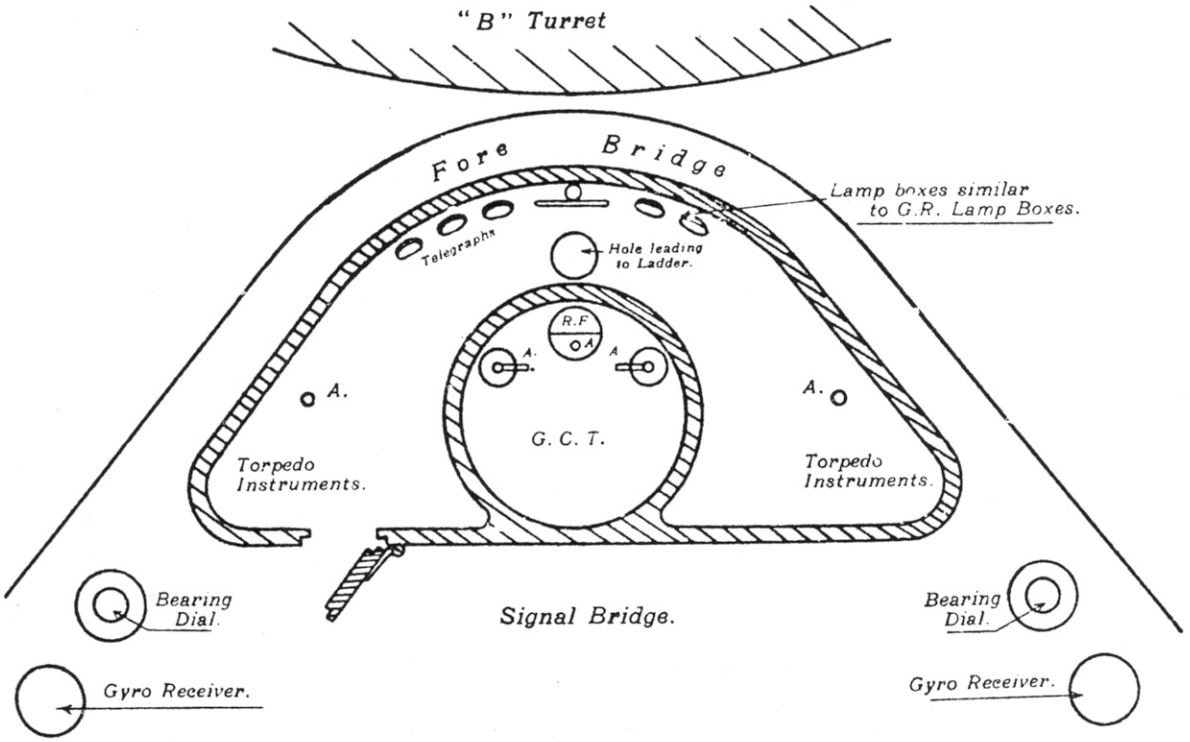
4 5 10 15 20 25 30 Metres

20 30 40 50 60 70 80 90 Feet

A sketch of the fire control arrangements in one of the König *class.*

'KRONPRINZ WILHELM'
GUN CONTROL POSITIONS
(Diagrammatic Sketch)





A = Periscope.

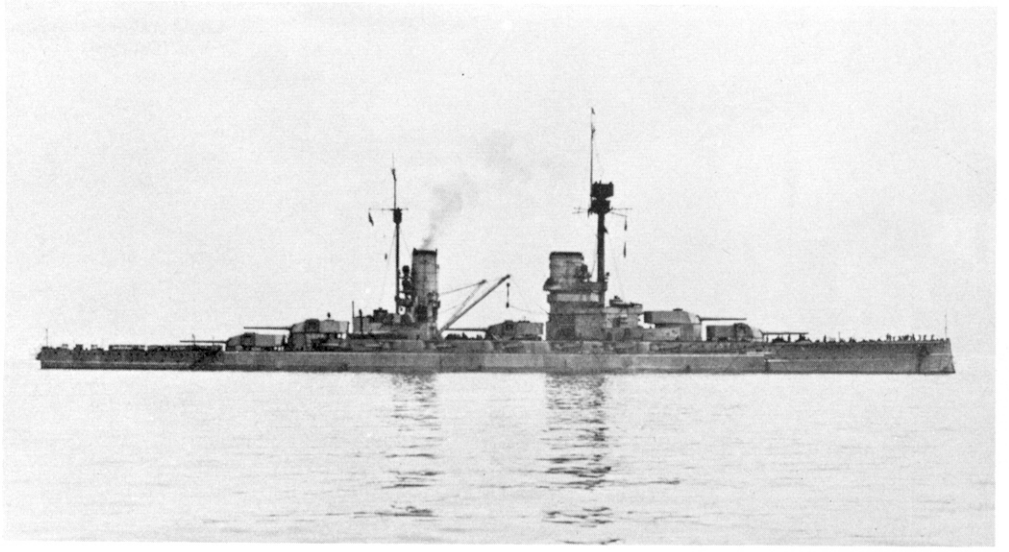
barbette was armoured to a thickness of 300mm for at least one deck below the weather deck and 200mm plated below that, down to the armoured deck.

The conning towers, fore and aft, were made out of hardened nickel steel, 350mm to 250mm thick forward and 350mm to 180mm aft.

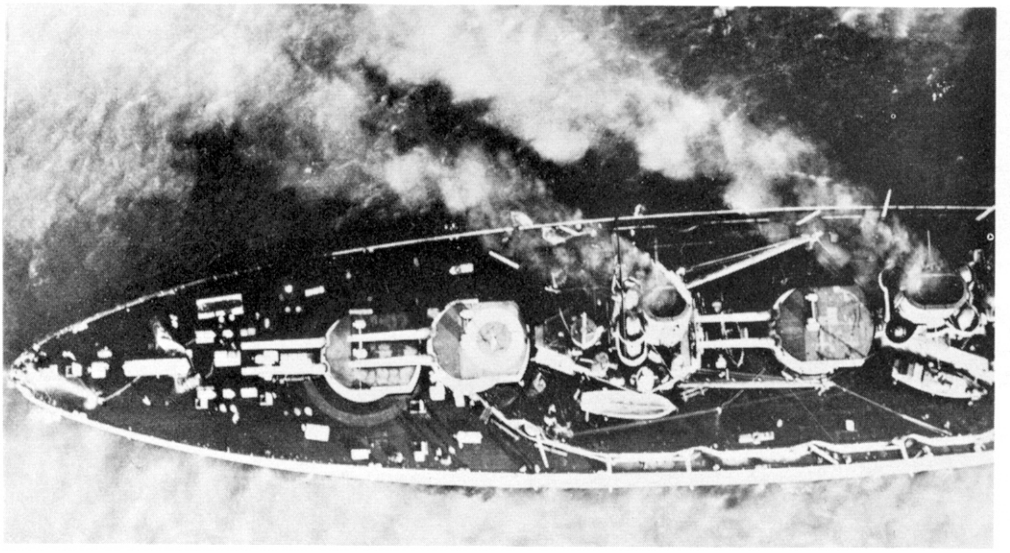
Fire Control System

As naval armaments progressed beyond the point where the fall of shot could be observed by a firing ship, systems of control had to be devised to allow the observation of fall of shot as far away as possible and to control the fire of the larger and larger number of great guns placed aboard ships, as the naval armaments race progressed.

The fire control system in *König* comprised long-base rangefinders, connected to a gunnery spotting top in the foremast; the torpedo control top, directly below the gunnery spotting top; the gun control tower, inside the main conning tower as well as a transmitting room in the bowels of the ship. The German system worked on the basis of the long-base range finder, in the operation of which the operator turned a knob until his Wandemark (a little cross or arrow which appeared in the range-taker's vision) appeared to him to be right over the target he was ranging on. The advantage was that he could range take on a smudge or ill defined object, while his British counterpart required an image which could be split horizontally. The system was electrically controlled so all five turrets could be fired together while hooked up through the ship's gyro compass and stable element, with the firing buttons being available to the gunnery



Starboard broadside SMS König *after reconstruction.* Drüppel)



Aerial view of a ship of the König *class during the war abaft the forefunnel.* (Drüppel)

officer, who could be in either the conning tower or the spotting top. The guns could be fired singly, in pairs, as a broadside salvo, or individually from the aforementioned positions.

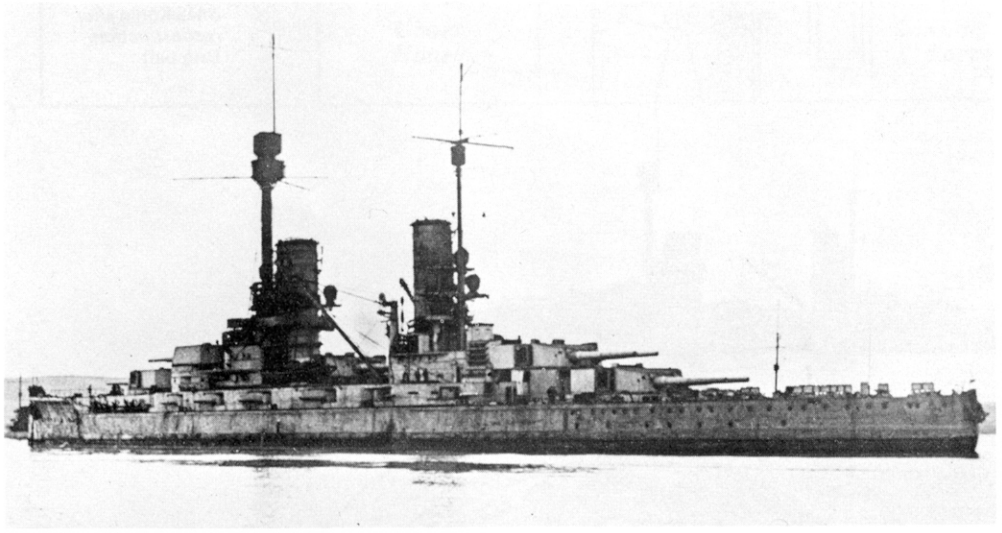
The *König* class carried seven Carl Zeiss Basis Gerät stereoscopic rangefinders for the main armament before her 1916 refit. These were located atop each conning tower and on all five 12in turrets. There were two additional rangefinders amidships for the secondary armament. The fire control system originally consisted of the rangefinders sending their input to the ship's gunnery officer in the fore control tower, who would take the average range given and shoot a salvo with a shell on the range, a shell above it and a shell below it both by a fixed distance. This ladder system allowed rapid correction and easy detection if the target changed course to avoid shellfire. It required that each gunlayer keep his sight on the target to compensate for the roll and motion of the ship.

After the 1916 refit, the *König*s were all given a large battle mast and an additional rangefinder on the foretop. This new arrangement, coupled with the German director firing system, which eliminated the necessity of gunlayers keeping the enemy in their sights was a great improvement. In each turret and by each casemate gun indicators were placed so that the guns need only be kept to the elevation and the turrets on the proper angle shown to hit the enemy.

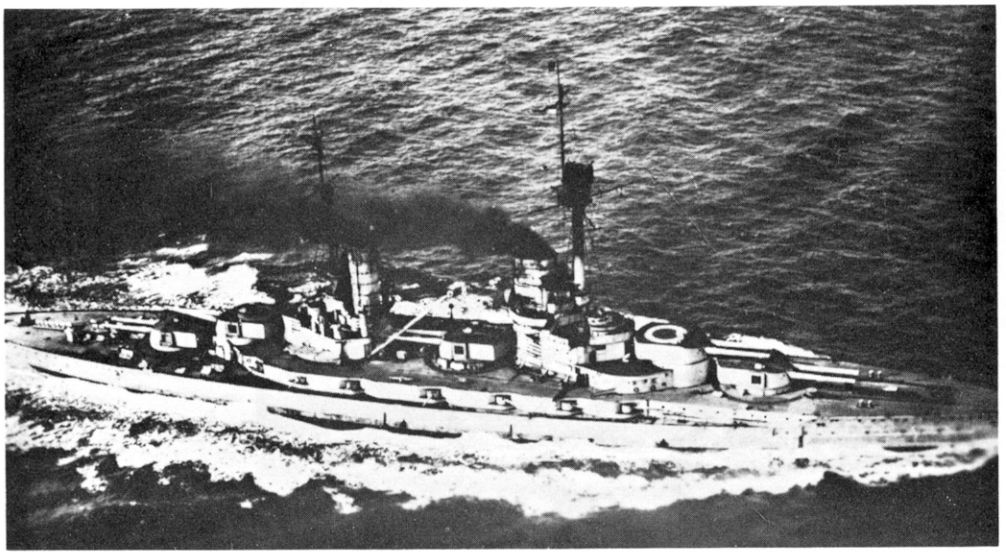
Each 12in turret had its own rangefinder, so it was possible to fire from individual turrets with some accuracy should the main fire control system be knocked out.

Secondary Armament

The secondary armament could be controlled from either the gunnery control tower or



König *interned at Scapa Flow.* (Drüppel)



König, *an aircraft recognition view.* (Drüppel)

spotting top. It was only fired by percussion.

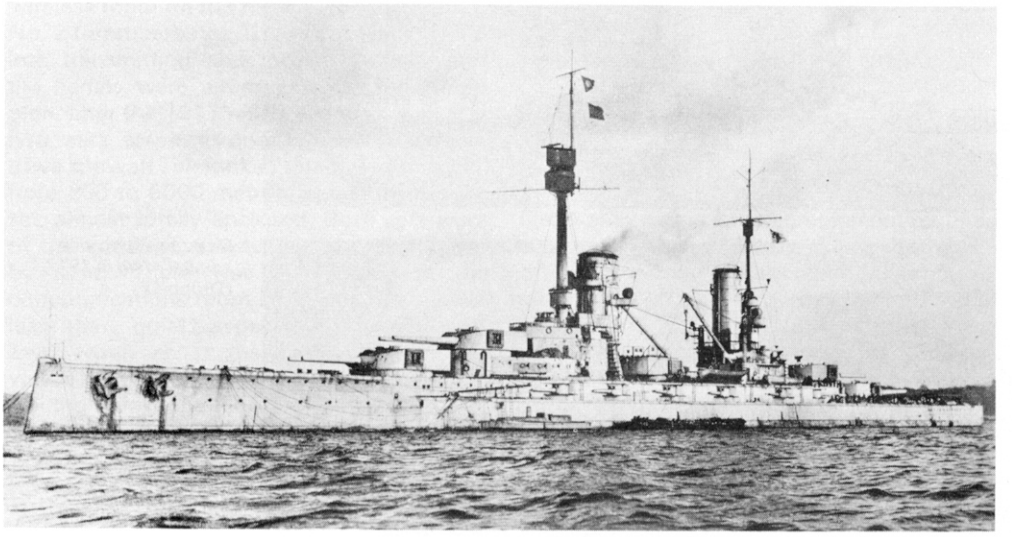
The secondary armament of the *König* class consisted of 14–5·9in (14×1) 45 calibre. These weapons had a 13,500 metre range range initially, which was increased to 16,800 metres in 1915. They fired a projectile 46kg in weight, and had a firing rate of seven rounds per minute. Four single late model 8·8cm (3·9in) 45cal Model 1913, anti-aircraft guns completed *König*'s armament. These had supplanted six 8·8cm (6×1) 35cal anti-torpedo boat guns which had been mounted in casemates abaft the bridge in the early part of the ship's career. They fired a projectile of 9·5kg in weight at a rate of about ten a minute.

Torpedo Tubes

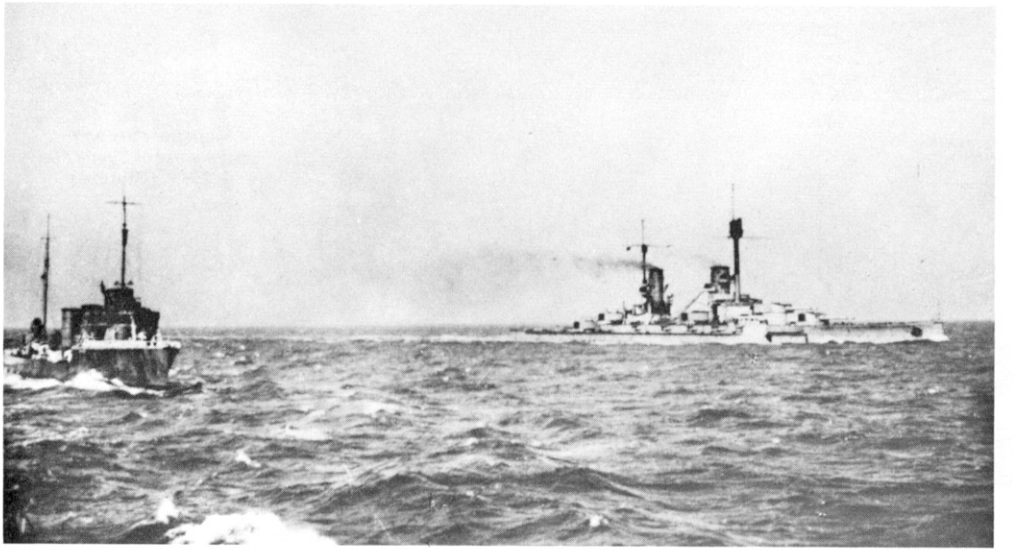
Three bow tubes and two stern tubes were fitted, each tube forward having stowage for ten torpedoes plus one in the tube; aft the stowage was for nine torpedoes plus one in each tube. These tubes fired a 50cm (19·7in) torpedo, and were fitted at an angle 20° before the beam. They were built with gyro angling gear and originally could be set for a 90° field of fire from their mountings. Later the tubes were fixed and angling gear removed. The torpedoes could be fired from either conning tower and two casemate positions on each side of the ship where the armour allowed observation of the enemy. All tubes could be fired from any of the controlling positions, but the casemate fire control positions were useful only for ahead and astern shots.

Navigation System

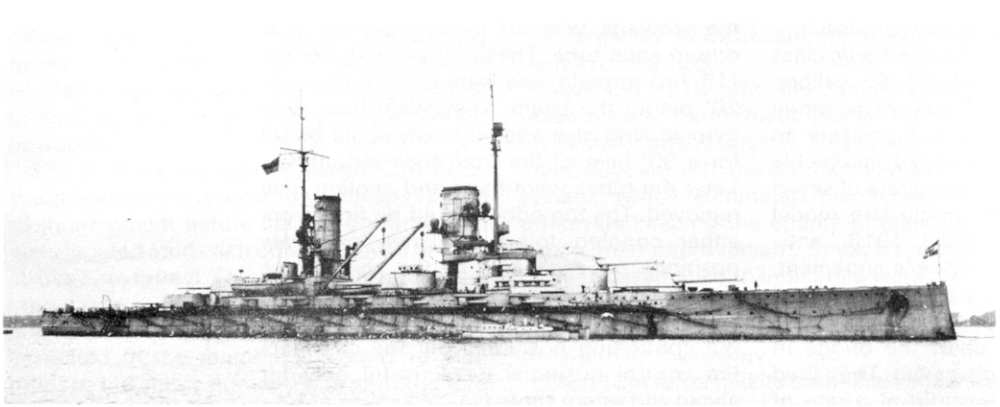
The *König*'s were advanced for their time, having two gyro compasses of the Anschutz type on board and several gyro repeaters, notably two on bridge wings and one in the



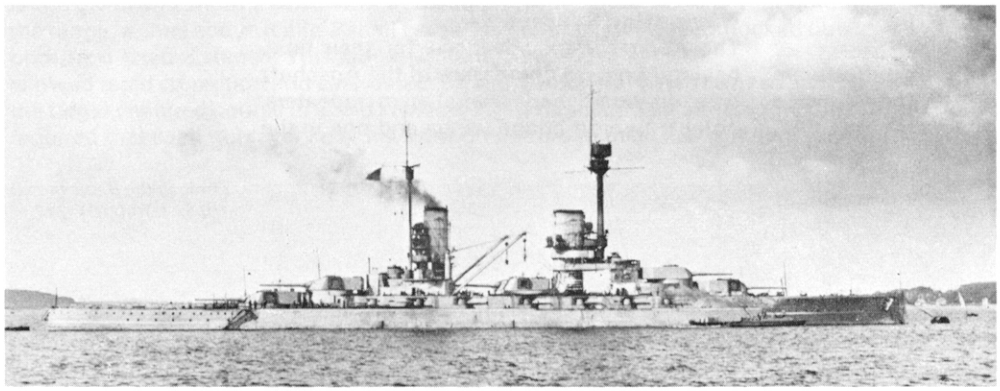
König *in the Baltic in 1918.* (Drüppel)



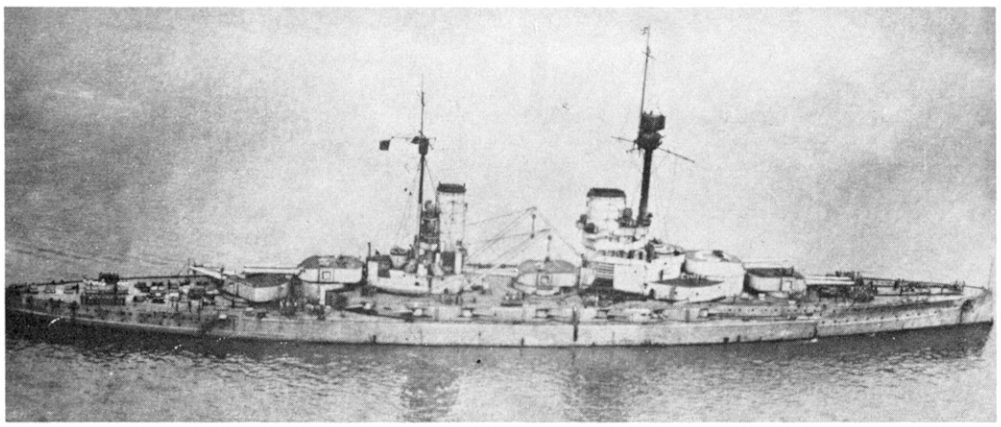
Grosser Kurfürst *and a torpedoboat in 1917.* (Drüppel)



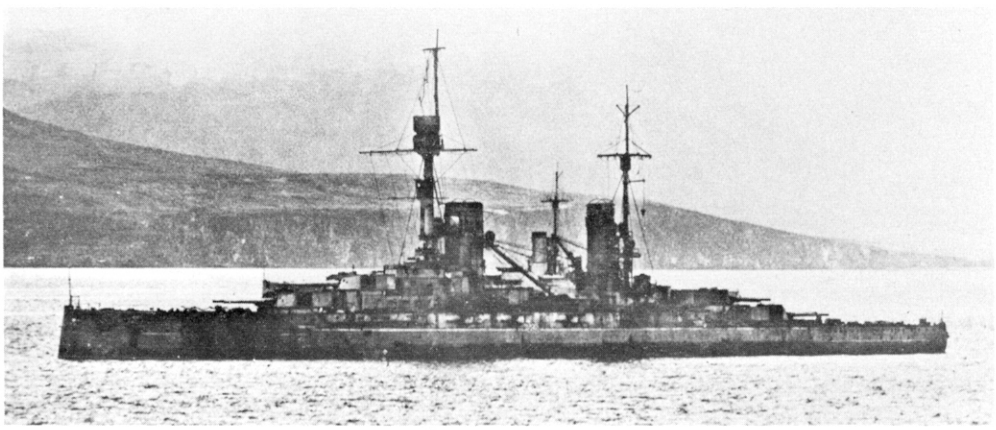
Markgraf *before Jutland.* (Drüppel)



Markgraf *after refit, 1917.* (Drüppel)



Markgraf *flying vice-admiral's flag in 1917.* (Drüppel)



Markgraf *dirty and unkempt at Scapa Flow in 1919.* (Drüppel)

conning tower next to the helmsman. Most of the other steering positions were also equipped with these as well as magnetic compasses. The *König* class also had two depth finders behind the armour belt. Thus the navigator could ascertain the depth of the water safely in foul weather and in combat. The importance of having a good gyro compass is paramount to navigation. In piloting it allows accurate fixes to be taken and is important in obtaining sun lines for navigation outside pilotage waters. Also, it allows a good dead-reckoning track to be kept. In all the navigator on board *König* had the best tools of his time available for navigation. The two master gyro compasses were located in the lower conning tower forward, and in the after submerged flat below the after steering position.

Communications

Equipment for the *König* class consisted of a wireless room on the middle deck, just abaft No. 2 turret barbette. This office was divided into transmitting and receiving areas, and the aerials were arranged as in the *König* plan, after the 1917 refit, she had apparently two sets for transmission and reception: a five kilowatt Telefunken set for wavelengths from 300 to 6000 metres, and a smaller arc set, almost totally enclosed. Both sets were of the continuous wave variety, and keyed by hand. There was no lagging in the communications room so it must have been less than quiet, especially during battle. Two receivers enclosed in boxes using valves were placed on a forward bench. Coding was the task of the operators themselves. Telephone and voice pipes were the means of communications to the conning tower.

Searchlights

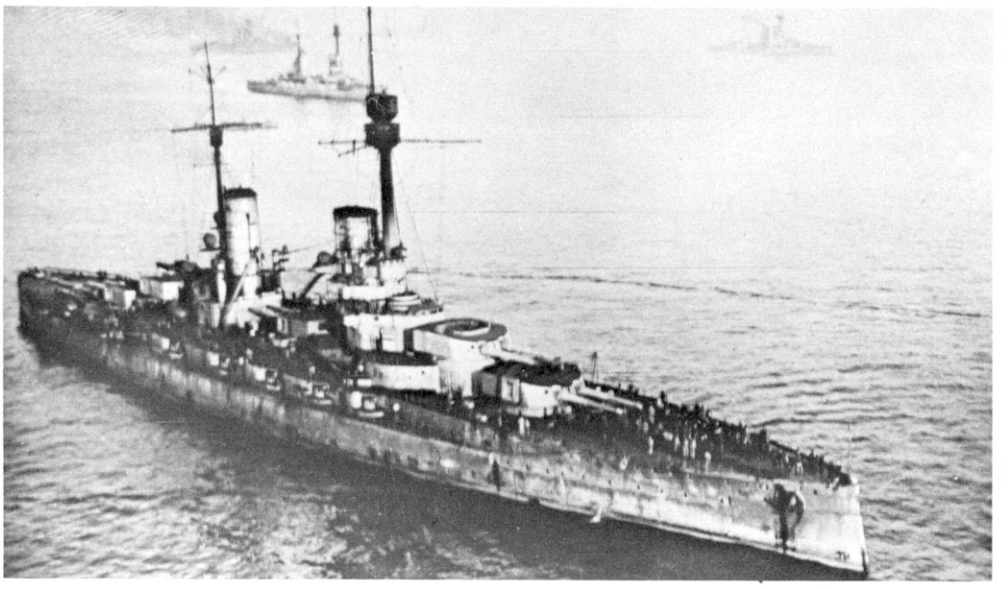
Eight 110cm, 120amp battle searchlights were mounted, four on the forward stack, four between the after stack and mainmast. The forward group had a bearing range of 170° for the upper lights and 128° for the lower. The after group had 152° and 189° respectively. These lights were each controlled from armoured positions. Tactics used were that a small beam of light would identify an adversary, and then he would be blinded by a 43·3in glare followed closely by a salvo of 12in shells. Additionally, *König* and her class carried an emergency searchlight which was also 120cm, a reserve searchlight of 120cm, and two signal searchlights of 17cm and 35amp power each.

Ships' Boats

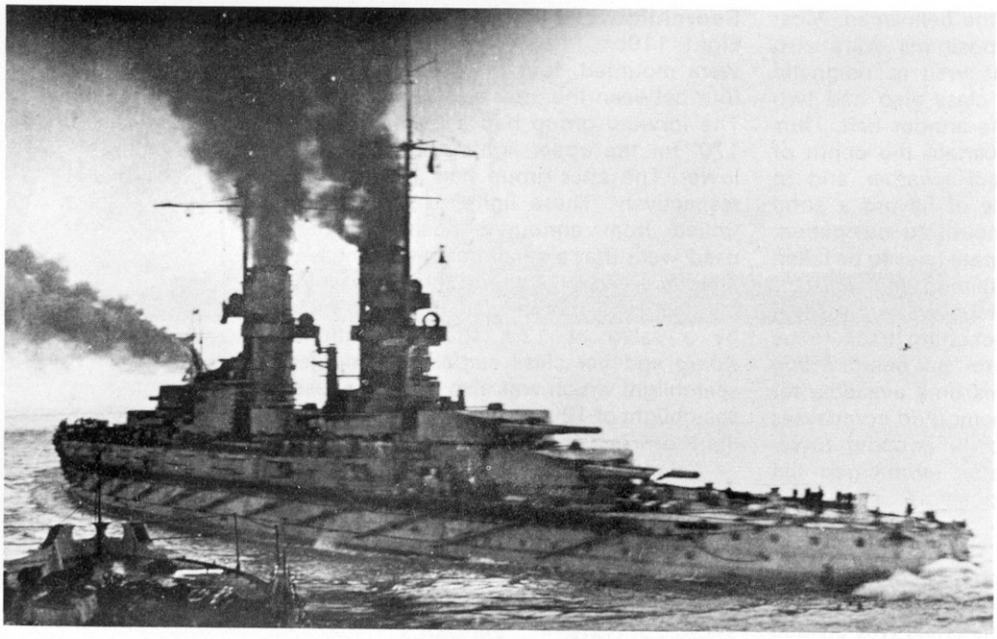
There was a precise allocation of boats for all ships in the Imperial German navy. The *König* allowance was as follows:

1 Steamboat, Class I	32ft 9in
2 Motorboats, Class A	47ft 7in
1 Motorboat No. 3	27ft 7in
1 Pinnace with motor	36ft
1 Pinnace without motor	36ft
2 Cutters Class O	33ft
2 Jollyboats Class I	19ft 6in
1 Motorboat Class C	39ft 4in

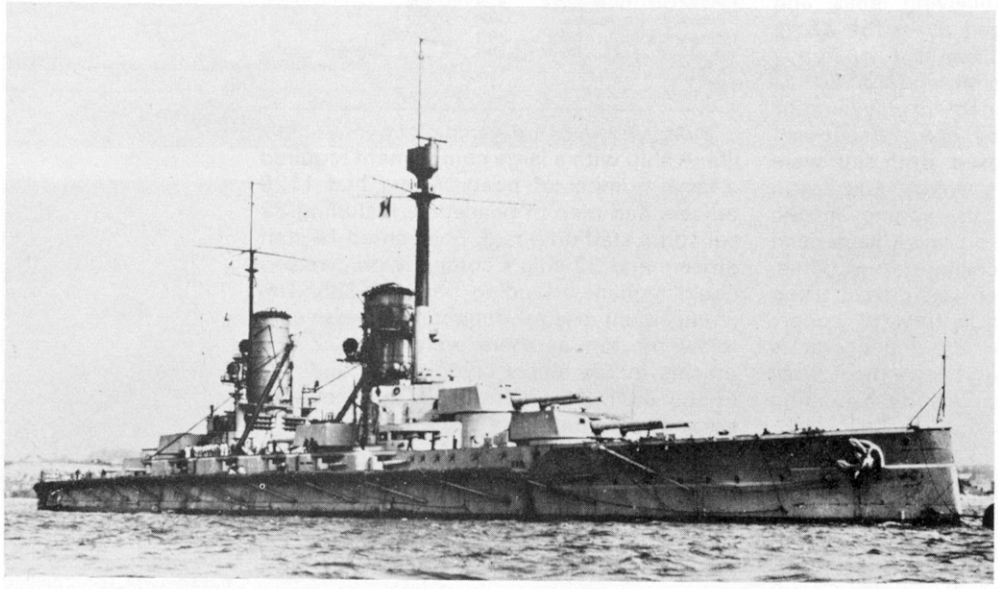
Boats were and are a vital part of any ship's life. A ship with a large complement required a large number of boats. *König* had 1129 officers and men in peacetime including 82 squadron staff on board. She carried 14 staff officers and 32 ship's company officers and could embark a landing party of 235. The arrangement seems definitely excessive in terms of staff as there were only 22 line officers in the ship's complement and five in the staff. This completes the technical essay on the *König*.



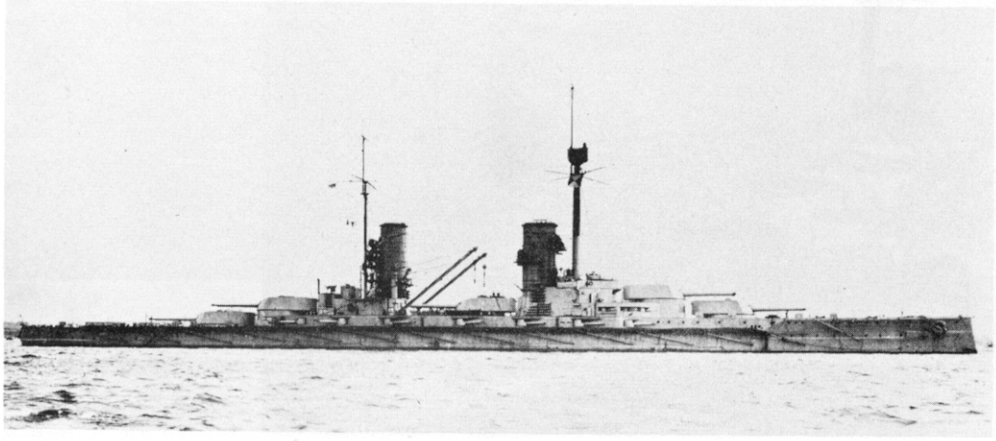
Markgraf *interned with ship of* Friedrich der Grosse *type and British battleships of* King George V *class in the background.* (Drüppel)



SMS Kronprinz *pulling into line early in the war. Note torpedo nets still shipped.* (Drüppel)



SMS Kronprinz *moored to a buoy. Note the heavy foremast: she was built this way.* (Drüppel)



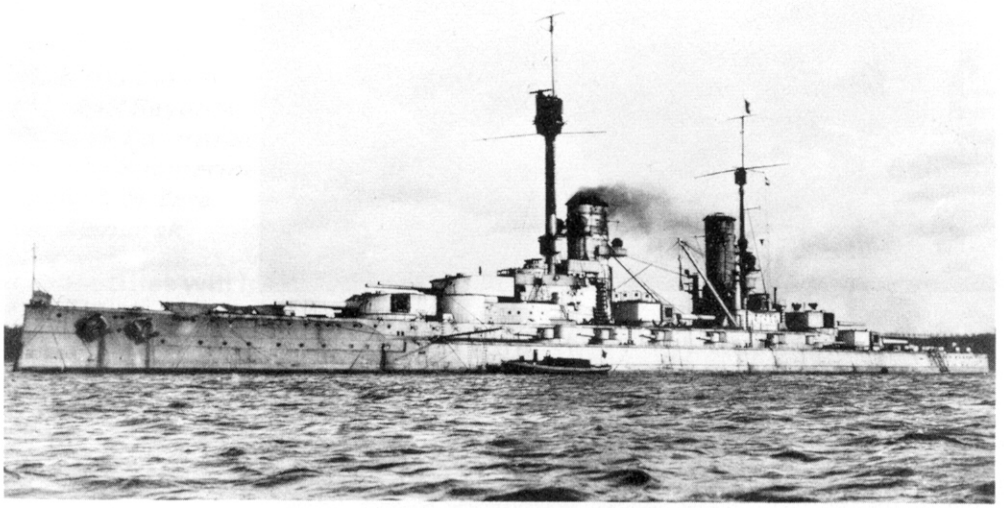
Kronprinz, *a broadside view before 1916.* (Drüppel)

Operational History of the König

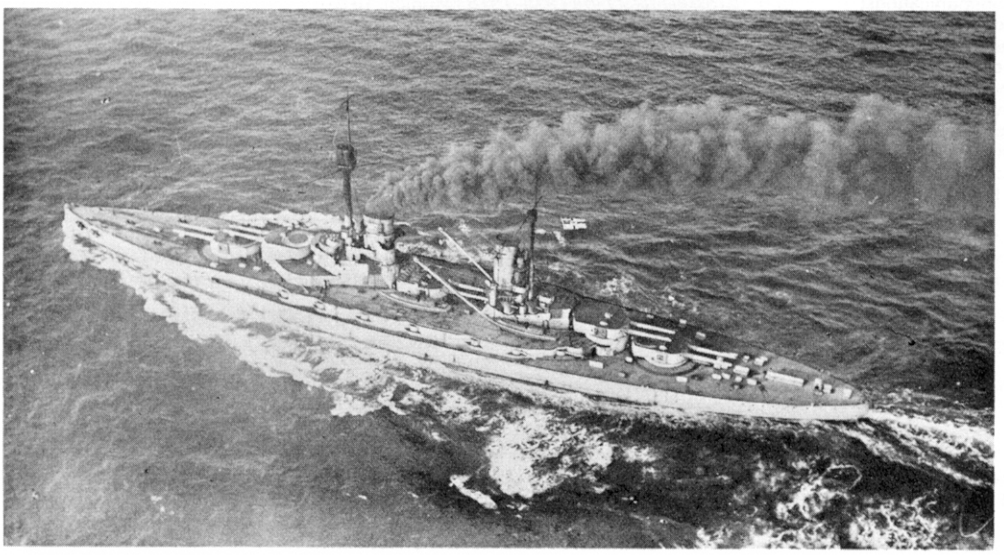
10 August 1914	placed in service
5-6 March 1916	operation in the Hoofden
25 April 1916	support for battle cruiser operation against Lowestoft and Yarmouth
31 May 1916	the Battle of the Skaggerak. Led battle line as a squadron flag, of Rear Admiral Paul Behnke, took 10 heavy shell hits and was repaired in Royal Dockyard Kiel by 21 July 1916.
19 August 1916	Operation against English East Coast
19 October 1916	Operation in the Dogger Bank
5 November 1916	Operation on Danish West Coast
11-19 October 1917	Bombarding and support of Operations Baltic Islands
17 October 1917	Action with the Russian battleship *Slava*
23 April 1918	Sortie to Northern North Sea
6 December 1918	Interned Scapa Flow
21 June 1919	Scuttled Scapa Flow in deep water
1962	rights to salvage sold to Scottish firm
1973	ship not yet raised

Table of Data (metric measure)

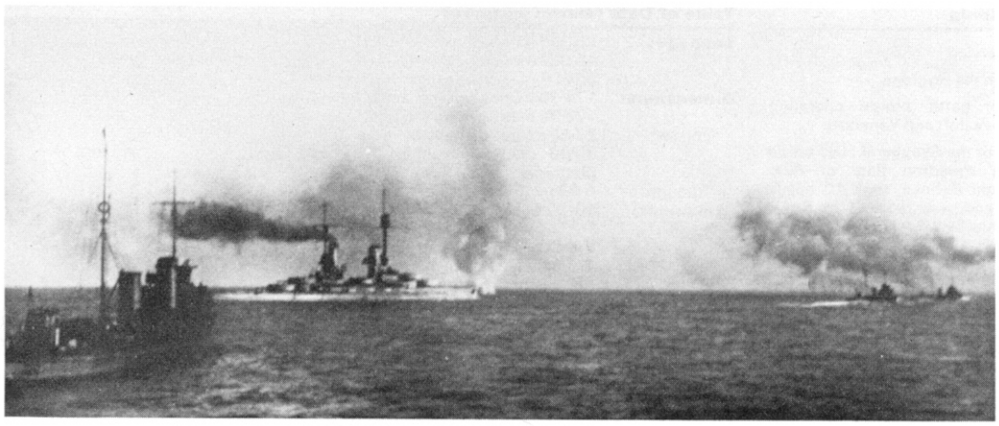
Tonnage:	25,796 tonnes displacement 14,839 tonnes weight full load 6044 tonnes weight light load
Dimensions:	174·70 metres between perpendiculars 175·70 metres along CWL
beam:	29·50 metres extreme beam as built 30·00 metres maximum for decks and platforms
draught:	8·33 metres
Armament:	10-30·5cm (5×2) 50cal Model '08 14-15cm (14×1) 45cal Model 6-8·8cm (6×1) 35cal removed 1915 4-8·8cm (4×1) 45cal AA 5-50cm torpedo tubes
Machinery:	3-triple stage Brown-Boveri-Parsons steam turbines 15-227 psi naval low pressure boilers 12 coal fired, 3 oil fired Shaft Horse Power: 43,300 at 251 rpm on three shafts
Fuel and endurance:	850 normal, 3600 tonnes full load
Oil:	Oil bunkerage: 700 tonnes
Complement:	32 ship's company officers 14 staff officers as flagship 1001 men ship's company 82 squadron staff



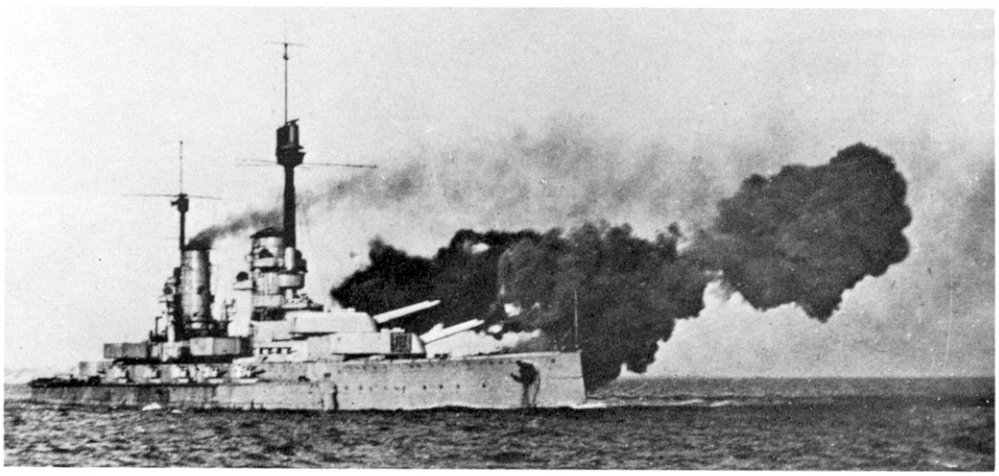
Kronprinz *from the port bow after Jutland.* (Druppel)



SMS Grosser Kurfurst *An aerial view taken en route to the surrender of the High Seas Fleet after the Armistice. Note the circle painted on No. 2 and No. 4 turrets for recognition by aircraft.* (IWM)



Kronprinz *and torpedo boats in action. Location unknown.* (Drüppel)



Kronprinz *firing a broadside, sometime in 1917.* (Drüppel)

Bibliography

Unpublished Sources

Bundesarchiv/Militärarchiv Freiburg; *Deutsche Kriegsflotte,* Band 1 Linienschiffe Heft 15. (Berlin 1915). This is a ship's characteristics book printed for service use in the Imperial German Navy containing in tabular form virtually all technical information on the *König, Markgraf* and *Grosser Kurfürst*. The exception to this is a blank section on communications.

US National Archives; Microfilm of the ship's log 1914-18. The orignial is in the Bundesarchiv.

Public Record Office, London; Documents of the Naval Inter-Allied Commission of Control (NIACC). These are German documents and plans confiscated by the Entente powers after the Armistice in 1918 under Versailles Treaty. These documents contain much information on the technology of the time. The plans of the *König* are held by the National Maritime Museum, Greenwich.

Naval Library, London; *German War Vessels 1914,* Naval Intelligence Division, Admiralty War Staff, 'General Information' and '*König* Class.' *German Navy,* N.I.D., Admiralty War Staff, 'Battleships and Battle-cruisers'.

German Material Organization, NID, AWS, 'Interned German Battleships'.

When compared with contemporary German documents, these British evaluations show a remarkable degree of accuracy.

Published Sources

Bennet, Geoffrey. *The Battle of Jutland* (London, Newton Abbot, 1972)

Brassey. *The Naval Annual, 1919.*

Breyer, Siegfried. *Schlachtschiffe und Schlachtkreuzer 1905-1970.* (Munich, 1970).

Breyer, Siegfried, and Forstmeier, Friedrich. *Deutsche Grosskampfschiffe 1915-1918* (Munich, 1970).

Notes on Sources

Frost, Cdr Holloway H. *The Battle of Jutland.* (Annapolis, 1964).

Greger, René. *The Russian Fleet 1914-1917.* (London, 1972).

Gröner, Erich. *Die Deutschen Kriegsschiffe 1815-1945.* Band 1 (Munich, 1966).

Hough, Richard. *Dreadnought* (London, 1965).

Marder, Arthur J., *From the Dreadnought to Scapa Flow,* vol III, (London ,1966).

Jane's Fighting Ships 1914.

Parkes, Dr Oscar, *British Battleships,* (London, 1970).

Scheer, Admiral Reinhard, *Germany's High Sea Fleet in the World War,* (London, 1920).

Steinberg, Jonathan. *Yesterday's Deterrent: Tirpitz and the Birth of the German Battlefleet,* (London, 1965).

These sources are by no means exhaustive, but should provide those interested with leads for further research.

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