= Lion @-@ class battlecruiser =

The Lion class were a class of battlecruisers built for the British Royal Navy before World War I. Nicknamed the " Splendid Cats " , the ships were a significant improvement over their predecessors of the Indefatigable class in terms of speed , armament and armour . The Lion @-@ class battlecruisers were 2 knots (3 @.@ 7 km / h ; 2 @.@ 3 mph) faster , exchanged the 12 @-@ inch (305 mm) guns of the older ships for 13 @.@ 5 @-@ inch (343 mm) guns , and had a waterline armour belt 9 inches (229 mm) thick versus the 6 inches (152 mm) of the Indefatigables . These improvements were in response to the German Moltke class , the first German battlecruisers , which were larger and more powerful than the first British battlecruisers of the Invincible class .

Lion served as the flagship of the Grand Fleet 's battlecruisers throughout World War I , except when she was being refitted or under repair . She sank the German light cruiser Cöln during the Battle of Heligoland Bight and served as Vice Admiral Beatty 's flagship at the battles of Dogger Bank and Jutland . She was so badly damaged at the first of these battles that she had to be towed back to port by the battlecruiser Indomitable and was under repair for more than two months . During the Battle of Jutland , Lion suffered a serious propellant fire that could have destroyed the ship if not for the action of Royal Marine Major Francis Harvey , the turret commander , who posthumously received the Victoria Cross for ordering the magazine to be flooded . However , the fire destroyed Harvey 's turret which had to be removed and rebuilt while the ship underwent repairs for several months .

Princess Royal participated in the Battle of Heligoland Bight a month after the war began and then was sent south to the Caribbean to prevent the German East Asia Squadron from using the Panama Canal . After the East Asia Squadron was sunk at the Battle of the Falkland Islands in December 1914 by the Invincible and Inflexible , Princess Royal rejoined the 1st Battlecruiser Squadron (BCS) . During the Battle of Dogger Bank she scored only a few hits , although one crippled the German armoured cruiser Blücher which allowed the enemy vessel to be caught and sunk by the concentrated fire of the British battlecruisers . Shortly afterwards , Princess Royal became the flagship of the 1st BCS , under the command of Rear Admiral Osmond Brock . She was then moderately damaged during the Battle of Jutland and required a month and a half of repairs afterwards .

Both ships spent the rest of the war on uneventful patrols in the North Sea , although they did provide distant cover during Second Battle of Heligoland Bight in 1917 . In 1920 they were both put into reserve and sold for scrap a few years later in accordance with the terms of the Washington Naval Treaty of 1922 .

= = Design and description = =

The acceleration of the German naval building programme in 1907 ? 08 forced the Government to yield to public pressure and authorize more ships for the 1909 ? 10 Construction Programme . Only a single battleship and a battlecruiser had been authorized in the 1908 ? 09 Construction Programme , but three battleships and a battlecruiser were authorized in the 1909 ? 10 Programme with another three battleships and a battlecruiser planned as " contingency " ships to placate the public and the Admiralty . Continuing pressure forced the Government to announce in July 1909 that the " contingency " ships would also be built . This pressure also allowed the Admiralty to gain approval to improve the size and power of its new ships so as to maintain qualitative superiority over the new German dreadnoughts then under construction .

The Lion @-@ class battlecruisers were designed to be as superior to the new German battlecruisers of the Moltke class as the German ships were to the Invincible class . The increase in speed , armour and gun size forced a 70 % increase in size over the Indefatigable class and made them the largest warships in the world . Their layout was adapted from the design of the first " super @-@ dreadnought " (or 13 @.@ 5 @-@ inch gunned) class , the Orion @-@ class battleships of 1910 . The ships were the first battlecruisers to be armed with the new model 13 @.@ 5 @-@ inch gun (343 mm) by Vickers . The design of the Lions remedied some of the shortcomings of the

preceding battlecruisers , which suffered from an inability for the en echelon amidships turrets to safely fire across deck , which limited them to a three turret broadside . This was done , however , because the greater size and weight of the new guns rendered beam turrets impracticable . As such , all four turrets in the Lions were arranged on the centreline , although ' Q ' turret was located amidships and was unable to fire directly aft . The Director of Naval Construction , Sir Philip Watts suggested that a fifth turret , superfiring over the rear turret , could be added if the ship was lengthened by three frames , 12 feet (4 m) in total , and that this would add very little cost other than the £ 175 @,@ 000 for the additional turret , but add 25 % more firepower to the ship . This was not approved , however , possibly because of doubts about its feasibility .

= = = General characteristics = = =

The Lions were significantly larger than their predecessors of the Indefatigable class . They had an overall length of 700 feet (213 @.@ 4 m) , a beam of 88 feet 6 @.@ 75 inches (27 @.@ 0 m) , and a draught of 32 feet 5 inches (9 @.@ 9 m) at deep load . They displaced 26 @,@ 270 long tons (26 @,@ 690 t) at load and 30 @,@ 820 long tons (31 @,@ 310 t) at deep load , over 8 @,@ 000 long tons (8 @,@ 100 t) more than the earlier ships . They had a metacentric height of 6 feet (1 @.@ 8 m) at deep load .

= = = Propulsion = = =

The Lion @-@ class ships had two paired sets of Parsons direct @-@ drive steam turbines , each of which was housed in a separate engine @-@ room . The wing shafts were coupled to high @-@ pressure turbines and these exhausted into low @-@ pressure turbines which drove the inner shafts . A cruising stage was built into the casing of each high @-@ pressure ahead turbine . Their three @-@ bladed propellers were 12 feet 3 inches (3 @.@ 73 m) in diameter on the inner shafts while the outer propellers were 11 feet 8 inches (3 @.@ 56 m) in diameter . The turbines were powered by forty @-@ two Yarrow water @-@ tube boilers in seven boiler rooms . They were designed to produce a total of 70 @,@ 000 shaft horsepower (52 @,@ 199 kW) , but achieved more than 76 @,@ 000 shp (56 @,@ 673 kW) during trials , although Lion did not exceed her designed speed of 28 knots (52 km / h ; 32 mph) and Princess Royal only reached 28 @.@ 5 knots .

They carried 3 @,@ 500 long tons (3 @,@ 556 t) of coal , and an additional 1 @,@ 135 long tons (1 @,@ 153 t) of fuel oil that was to be sprayed on the coal to increase its burn rate . At full capacity , they could steam for 5 @,@ 610 nautical miles (10 @,@ 390 km ; 6 @,@ 460 mi) at a speed of 10 knots (19 km / h ; 12 mph) .

= = = Armament = = =

The Lion @-@ class ships mounted eight BL 13 @.@ 5 @-@ inch Mark V guns in four twin hydraulically powered turrets , designated ' A ' , ' B ' , ' Q ' and ' Y ' . Unlike the two previous classes of battlecruiser in the Royal Navy , which had turrets fore , aft and on each wing of the ship , the Lion class ships had their main armament mounted in a single line from front to rear , with ' B ' turret superimposed over ' A ' turret , ' Q ' turret mounted amidships , and ' Y ' turret aft . The guns could be depressed to ? 3 ° and elevated to + 20 ° , although the rangefinders controlling the turrets were limited to + 15 ° 21 ' until superelevating prisms were installed before the Battle of Jutland in May 1916 to allow full elevation . They fired 1 @,@ 250 @-@ pound (567 kg) projectiles at a muzzle velocity of 2 @,@ 582 ft / s (787 m / s) ; at 14 @.@ 75 ° , this provided a maximum range of 20 @,@ 000 yd (18 @,@ 288 m) with armour @-@ piercing (AP) shells . At 20 ° elevation , the range was extended to 23 @,@ 820 yd (21 @,@ 781 m) . The rate of fire of these guns was 1 @.@ 5 ? 2 rounds per minute . The ships carried a total of 880 rounds during wartime for 110 shells per gun .

Their secondary armament consisted of sixteen BL 4 @-@ inch Mark VII guns , most of which were mounted in casemates . The guns on their PII * or PIV * mounts had a maximum elevation of 15 ° .

They fired 31 @-@ pound (14 @.@ 1 kg) projectiles at a muzzle velocity of 2 @,@ 864 ft / s (873 m / s) ; this gave a maximum range of 11 @,@ 600 yd (10 @,@ 607 m) . Their rate of fire was 6 ? 8 rounds per minute . They were provided with 150 rounds per gun .

The Lion @-@ class ships were built without anti @-@ aircraft guns , but a variety of guns were fitted over the course of the war . These included the QF 6 pounder Hotchkiss gun on HA MkIc mounting . This had a maximum depression of 8 ° and a maximum elevation of 60 ° . It fired a 6 @-@ pound (2 @.@ 7 kg) shell at a muzzle velocity of 1 @,@ 765 ft / s (538 m / s) at a rate of fire of 20 rounds per minute . It had a maximum ceiling of 10 @,@ 000 ft (3 @,@ 000 m) , but an effective range of only 1 @,@ 200 yards (1 @,@ 100 m) . QF 3 inch 20 cwt AA guns on high @-@ angle MkII mounts were also used . They had a maximum depression of 10 ° and a maximum elevation of 90 ° . They fired a 12 @.@ 5 @-@ pound (5 @.@ 7 kg) shell at a muzzle velocity of 2 @,@ 500 ft / s (760 m / s) at a rate of 12 ? 14 rounds per minute . It had a maximum effective ceiling of 23 @,@ 500 ft (7 @,@ 200 m) .

Princess Royal received two 4 @-@ inch Mark VII guns on HA MkII mounts capable of 60 ° of elevation in April 1917 and a pair of single 2 @-@ pdr MK II " pom @-@ poms " were added in April 1919 . They fired 40 @-@ millimetre (1 @.@ 6 in) shells weighing 2 pounds (0 @.@ 9 kg) at a muzzle velocity of 1 @,@ 920 ft / s (590 m / s) to a maximum effective range of 1 @,@ 200 yards (1 @,@ 097 m) . Their practical rate of fire was between 50 and 75 rounds per minute .

Two 21 @-@ inch (533 mm) submerged torpedo tubes were fitted on the beam . Fourteen Mark II * * * torpedoes were carried which had a warhead of 515 pounds (234 kg) of TNT . They had two speed settings which governed their range ; at 45 knots (83 @.@ 3 km / h ; 51 @.@ 8 mph) they could reach 4 @,@ 500 yards (4 @,@ 115 m) or 10 @,@ 750 yards (9 @,@ 830 m) at 31 knots (57 @.@ 4 km / h ; 35 @.@ 7 mph) .

= = = Fire @-@ control = = =

The main guns of the Lion @-@ class ships were controlled from the conning tower . Data from a 9 @-@ foot (2 @.@ 7 m) Argo rangefinder located on top of the conning tower was input into a Mk I Dreyer Fire Control Table located in the transmitting station (TS) below the conning tower where it was converted into range and deflection data for use by the guns . The target 's data was also graphically recorded on a plotting table to assist the gunnery officer in predicting the movement of the target . ' B ' and ' X ' turrets were provided with nine @-@ foot rangefinders and were fitted as secondary control positions .

Fire @-@ control technology advanced quickly during the years immediately preceding World War I and the development of the director firing system was a major advance . This consisted of a fire @-@ control director mounted high in the ship which electrically provided gun data to the turrets via pointers , which the turret crewmen only had to follow . The director officer fired the guns simultaneously which aided in spotting the shell splashes and minimized the effects of the roll on the dispersion of the shells . Lion received her system in early 1915 while undergoing repairs after the Battle of Dogger Bank and Princess Royal got hers in early 1916 . A second director was added to each ship in 1918 .

= = = Armour = = =

The armour protection given to the Lions was heavier than that of the Indefatigables ; their waterline belt of Krupp Cemented Armour measured 9 inches (229 mm) thick amidships in contrast to the 6 @-@ inch (152 mm) belt of their predecessors . It thinned to four inches towards the ships ' ends , but did not reach either the bow or the stern . In addition they were given an upper armour belt with a maximum thickness of six inches over the same length as the thickest part of the waterline armour and thinned to 5 inches (127 mm) abreast the end turrets . Four @-@ inch transverse bulkheads closed off the ends of the armoured citadel . Nickel @-@ steel plating was used for the protective decks . The lower armoured deck was generally only 1 inch (25 @.@ 4 mm) thick except outside the citadel where it was 2 @.@ 5 inches (64 mm) . The upper armoured deck was situated at the

top of the upper armour belt and was also only one inch thick . The forecastle deck ranged from 1 @.@ 25 to 1 @.@ 5 inches (32 to 38 mm) .

The gun turrets had 9 @-@ inch front and sides while their roofs were 2 @.@ 5 to 3 @.@ 25 inches (64 to 83 mm) thick . The barbettes were protected by 9 inches of armour above the deck , but it thinned to 8 inches (203 mm) above the upper armour deck and 3 inches (76 mm) below it . The conning tower sides were 10 inches (254 mm) thick and it had a three @-@ inch roof and communication tube . Nickel @-@ steel torpedo bulkheads 2 @.@ 5 inches (64 mm) thick were fitted abreast the magazines and shell rooms . Her funnel uptakes were protected by nickel @-@ steel splinter armour 1 @.@ 5 inches (38 mm) thick on the sides and one inch on the ends between the upper and forecastle decks . After the Battle of Jutland revealed her vulnerability to plunging shellfire , one inch of additional armour , weighing approximately 130 long tons (132 t) , was added to the magazine crowns and turret roofs .

= = Construction = =

Only Lion was completed to the original design , which had the foremost funnel placed between the forward superstructure and the tripod foremast . This meant that hot clinker and flue gases from the boilers made the spotting top on the foremast completely unworkable when the ships were steaming at high speed , that the upper bridge could easily be rendered uninhabitable , depending on the wind , and that the signal flags and halyards were at risk of burning . Both ships were altered to correct this problem , Lion before she commissioned , and Princess Royal as she was fitting out , at a total cost of £ 68 @,@ 170 . The fore funnel was replaced and moved aft , the original fore and mainmasts exchanged position , although the foremast was now just a pole mast , not a tripod , the spotting tower at the rear of the conning tower was removed , the conning tower enlarged , the 9 @-@ foot Argo rangefinder was moved from the foremast spotting top to the roof of the conning tower , and all the funnels were raised to the same height . The two four @-@ inch guns mounted above the forward group of casemates were enclosed in casemates of their own to protect the gun crews from weather and enemy action as part of these modifications .

Although the standard British practice was to quote the cost without armament , the data available for the Lions includes guns .