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Journal



No. 18

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Front cover picture:
Block of four Airmail Stamps as used by Provincial Airways on their short-lived Airmail service in 1933. (see: ‘Southampton International Airport 1910-1946’)

Back cover pictures:
Steam pumping engines at Otterbourne c1970. (see: ‘The Southampton Corporation Waterworks at Otterbourne’)

Hampshire Industrial Archaeology Society

(formerly Southampton University Industrial Archaeology Group)

Journal No. 18, 2010

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Editorial

Welcome to Issue **18** of our *Journal*. Once again the *Journal* has articles on a variety of Hampshire subjects.

In the year when the first steel is cut in Portsmouth for the Royal Navy's new aircraft carrier, Ian Sturton looks back at seventy years of warships built at Portsmouth up to the First World War. These years saw the evolution of the modern navy. Flights from the site of Southampton Airport have been taking place for a century and Jeff Pain chronicles the early developmental era up to the end of the Second World War. Your editor writes on the Otterbourne waterworks which have supplied Southampton and environs with drinking water for over a century and a quarter. Of the three sites, Otterbourne, Timsbury and Twyford, Otterbourne was by far the largest and, in steam days, the most impressive. Gas was the first energy source to be distributed to customers from a central production facility. In the nineteenth century, every town had its local gas works. Emsworth was no exception and John Horne and Jane Yoward detail the history of the Emsworth concern.

Martin Gregory
May 2010

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The Contributors

Martin Gregory
Martin Gregory is a retired schoolmaster. His interest in the history of technology goes back nearly 50 years. He has researched and built model steam and Stirling engines for many years and also works on the history of the sewing machine. He has been a member of HIAS and its predecessor for over 35 years, has served as Secretary and Chairman and is the present editor of the Journal.

John Horne
John Horne is an engineer, now retired, who has lived near Southampton since 1969, though originally from Liverpool. He served several terms as Secretary and then Chairman of the former SUIAG. Interested in most aspects of industrial and business history, he concentrates on transport and Public Utility matters. Current projects include a 'Virtual Archive' for the Gas Industry and the listing of material donated by Vosper-Thornycroft when they left their Woolston shipyard.

Jeff Pain
Jeff Pain has been a member of the Hampshire IA group since its early days in the 1960s. He was born in Southampton and, apart from wartime, has always lived and worked in the area. Educated at Taunton's School, he followed his father into the shipping world, being employed in Freight, Passenger and Ship Agency work. After the reorganisation of shipping, he spent twenty years or so with Pirelli, first at Southampton and, when that closed, at Eastleigh. His main interest has always been in transport covering ships, railways and aircraft, with road interest limited to trams and buses.

Ian Sturton
Ian Sturton has been an enthusiastic investigator of post-1860 warships and warship designs for many years, publishing and illustrating articles in a number of journals. He retired recently from Winchester College Science School.

Jane Yoward
Jane Yoward was brought up in Emsworth. She spent 30 years in IT before leaving the industry and eventually becoming a Senior Housing Benefit Officer for Portsmouth City Council. She was aware of Industrial Archaeology through the interest of her parents, Tony & Mary Yoward, before she then attended an evening class in Reading in the mid-1980s, given by Ken Major. On moving back to Emsworth in 1987, she joined the Southampton Industrial Archaeology Group and then the Hampshire Mills Group. In 1995, she took a GCSE in Local History and, as part of it, had to produce a 4,000 word local study. One of the subjects was IA and she decided to study the Emsworth Gas and Coke Company.

Acknowledgements

My thanks are due to all who have contributed to this edition of the *Journal*. Acknowledgements and thanks for the provision of illustrations are made as follows:

M. Gregory, (Figs. 41, 43-4, 46, 50-1, 54, back cover); D. Hatchard, (Figs. 30-1); J.B. Horne, (Figs. 59-64); Peter New Coll. (Fawley Historians), (Figs. 25, 28-9, 32, 36-7, 39); J. Pain, (Figs. 26-7, 33-5, 38, 40, front cover); Preston Steam Services, (Fig. 55); Southampton Corporation Waterworks, (Figs. 52-3); I.A.Sturton, (Figs. 1-24); Twyford Waterworks Trust archives, (Figs. 42, 45, 47-9); A. Yoward, (Figs. 56-8, 65).

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Spithead Cavalcade: Some Celebrated Portsmouth-Built Warships, 1850-1920

Ian Sturton

Portsmouth Dockyard built around 300 warships over 500 years, using wood for hull construction until 1860, then iron for about 20 years, then steel. The first ship recorded was the King's ship *Sweepstake* of 1497, the last was the general-purpose frigate *Andromeda*, completed in 1969. Outside the dockyard, warship construction in Vosper Thornycroft's former facility, now part of BAE Systems Surface Ships, continues to the present.

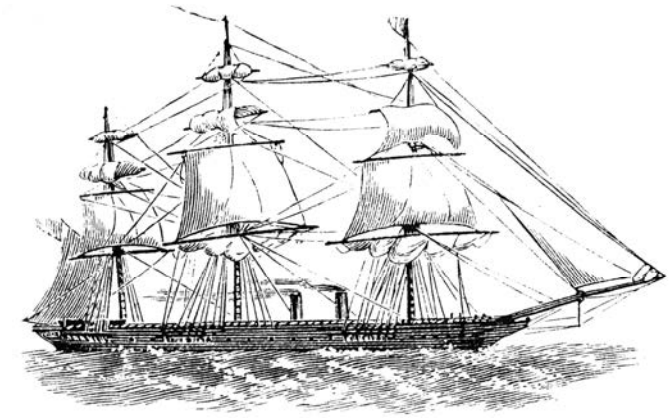


Fig. 1. Woodcut of HMS *Warrior*, a broadside ironclad carrying 32 guns.

Early Portsmouth-built armoured ships provide an introduction to the naval advances of the day. The steps leading from the ironclad of 1860 to the first-class battleship of the 1890s broadly followed two tracks. One, conservative, started with the broadside ironclad, a wooden (French *Gloire*) or iron (*Warrior*) ship with external wrought iron armour and a row of guns under the top deck. After advancing through the belt-and-battery and box battery types to the central battery of 1875-76, it went no further. Portsmouth dockyard produced only one ship in this sequence, the broadside ironclad *Royal Alfred*.

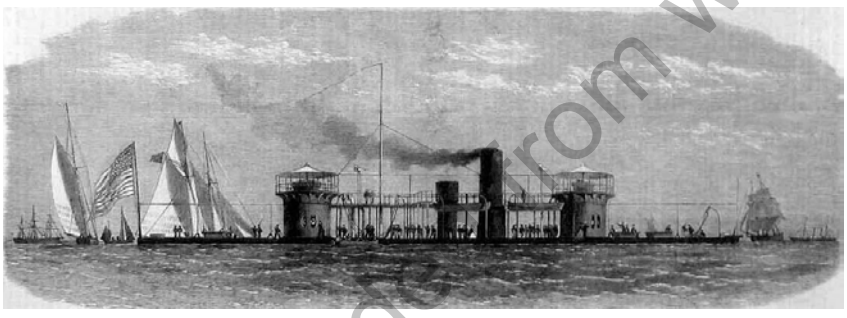


Fig. 2. Woodcut of American turret ship *Miantonomoh*, an improved *Monitor*, at Portsmouth. *Miantonomoh* made an extended trip to Europe in 1866-67, when she visited Portsmouth.

The second, radical, track began with the turret ship, an entirely new departure. Its development is attributed to the strenuous exertions of Captain Cowper Coles in the Royal Navy and John Ericsson's work in the American Civil War [1]. Further progress proved difficult, and ten years elapsed before the completion of the first fully satisfactory ocean-going turret ship. A number of famous ships of this type were built in the dockyard.

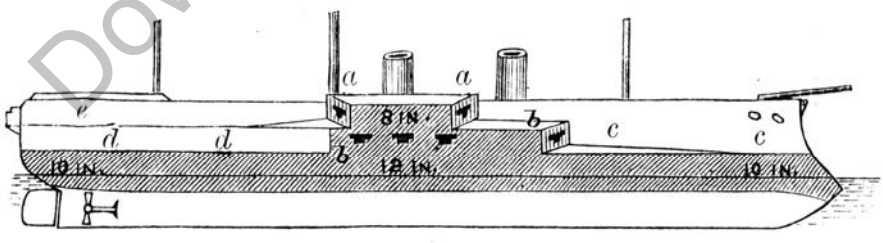


Fig. 3. Diagram showing the disposition of armour in HMS *Alexandra* (1875), a twin-screw, central battery battleship, 1st class. 9490 tons, 8610 ihp, 18 guns. (a) upper battery, 2-11in (280mm) 25-ton and 2-10in (254mm) 18-ton MLR; (b) main battery, 8-10in MLR (six 6in [152mm] guns on the upper deck are not shown). (c) men's quarters; (d) officers' quarters; (e) poop.

British sea power depended on battleships, much less on frigates and corvettes, the eyes of the fleet. The development of iron and steel cruising ships post-dated that of battleships, and was less coherent. New cruiser types were often pioneered by private shipyards for minor overseas navies; the Admiralty could afford to wait and see without endangering national security. Portsmouth-built

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British cruising ships, therefore, while still of technological interest, have been highlighted because of episodes in their service careers.

The arrival of heavy guns and armour at sea required the adaptation of terms from land fortifications usage, thus a barbette gun fired over the top of armour ("*en barbette*"), while a casemate gun fired through a port in an armoured box, and had a deck overhead. Other requisitioned military terms included battery, breastwork, citadel, redoubt and glacis.

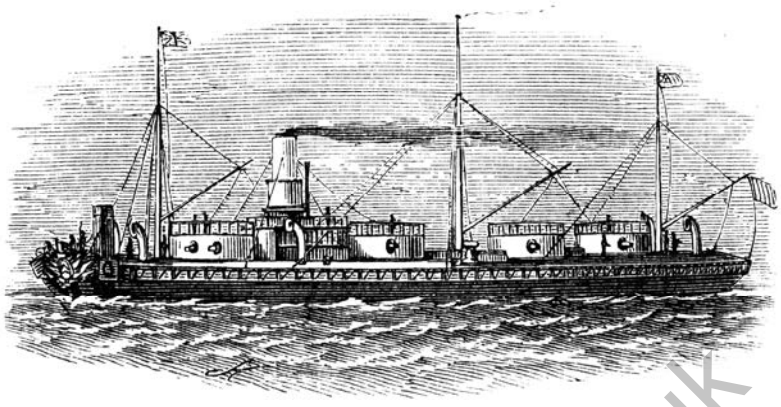


Fig. 4. Woodcut of turret-ship HMS *Royal Sovereign* with hinged bulwarks lowered.

Royal Sovereign (1857-85). The *Royal Sovereign*, the first British turret ship, was begun at Portsmouth in December 1849 as a 130-gun screw three-decker, a steam *Victory*. Launched on 25 April 1857, she had run steam trials but was still incomplete when news of the *Monitor*-*Virginia* encounter[2] reached Britain. Interest in turret ships was boosted, and the order for the conversion of *Royal Sovereign* to a turret ship was dated 3 April 1862. The three-decker's lofty wooden hull was dismantled down to the lower deck, which became the new upper deck; the remaining woodwork was completely plated with 5.5 in (140 mm) of iron to three feet (0.9 m) below the waterline and the deck covered with a one inch (25 mm) iron deck. Four Coles turrets with 5.5 in armour were installed on the new upper deck, all on the centre line. The fore turret carried two heavy guns, the others one each. The 10.5 in (267 mm) 12.5 ton smooth bores first fitted were replaced in 1867 with 9 in (229 mm) 12.5 ton muzzle-loading rifled guns (MLR). She was completed on 20 August 1864 – at which time nineteen US ships with Ericsson turrets were in service across the 'pond'. She was not the first turret ship proposed in Britain, as in February 1861, the Admiralty had approved the construction of the smaller iron-hulled *Prince Albert;* however, the latter was not ready until 1866.

The massive timber construction required to support heavy turrets and hull armour restricted coal supplies to 280 tons, about three days steaming. Draught was deeper, so she was slower than unconverted ships. Ballard noted that as a turret ship she was tactically very successful, being able to turn any unconverted 130-gun ship into a bonfire while herself remaining undamaged, but strategically less so than in her unconverted form, which could support British interests anywhere in the world. The freeboard amidships was seven feet (2.1 m), augmented by 3ft 6in (1 m) hinged iron bulwarks. Her only significant sea passage was one round trip from Portsmouth to Cherbourg.

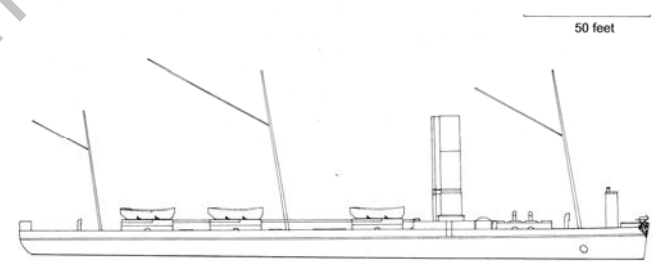


Fig. 5. Line drawing of HMS *Royal Sovereign* with hinged bulwarks raised.

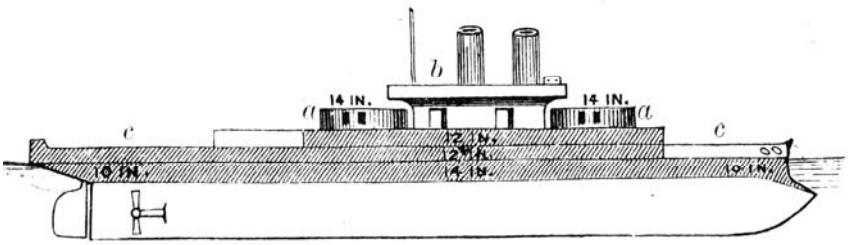


Fig. 6. Diagram showing the disposition of armour in HMS *Devastation* (1872), a twin-screw double-turret battleship, 1st class. 9330 tons, 6650ihp, 4-12in (305mm) 35-ton MLR in pairs in turrets. (a), (a) turrets; (b) superstructure; (c) upper deck.

Devastation (1872-1908) The turret ship *Devastation* was the first ocean-going armoured ship without sail power in any navy. Ericsson's monitors had insufficient freeboard to operate reliably at sea. The 3340 ton turret ship *Cerberus*, designed by Chief Constructor Edward Reed to defend Port Phillip and Melbourne, had been built with a breastwork, an additional armoured structure one deck high on the basic monitor hull, to improve seaworthiness and provide a base for turrets and superstructure. When called upon for a full size ocean-

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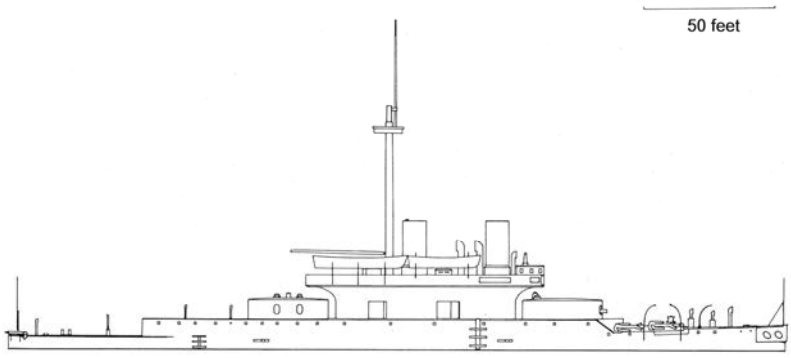


Fig. 7. Line drawing of HMS *Devastation*.

going turret ship, he enlarged the *Cerberus* into the much bigger *Devastation*. Dimensions of 285 ft (87 m) length between perpendiculars, by 58 ft (17.7 m) beam by 26 ft 8 in (8.1 m) mean draught, gave a displacement of 9300 ton; freeboard was 8 ft 6 in (2.6 m) at the bow, 10 ft 9 in (3.3 m) amidships and only four feet (1.2 m) aft. As built, there were two 12 in (305 mm) 35 ton MLR in each turret, firing through ports 13 feet (4.0 m) above the waterline and ranging to about four miles (6.4 km). Since decks were more open to attack than in higher broadside ships, 556 tons of armour was provided for protective decks two or three inches (51 mm or 76 mm) thick. There were 104 watertight compartments, 68 in the interior of the ship and 36 in the double bottom and wings. Twin screws and bunkers for enough coal to cross the Atlantic to Halifax or Bermuda made sail power superfluous, while the absence of poop and forecastle allowed turrets to fire across bow and stern. The low freeboard caused misgivings; according to Parkes, when *Devastation* started sea trials in 1873, a notice, "Letters for the Captain may be posted aboard", was found affixed to the gangway.

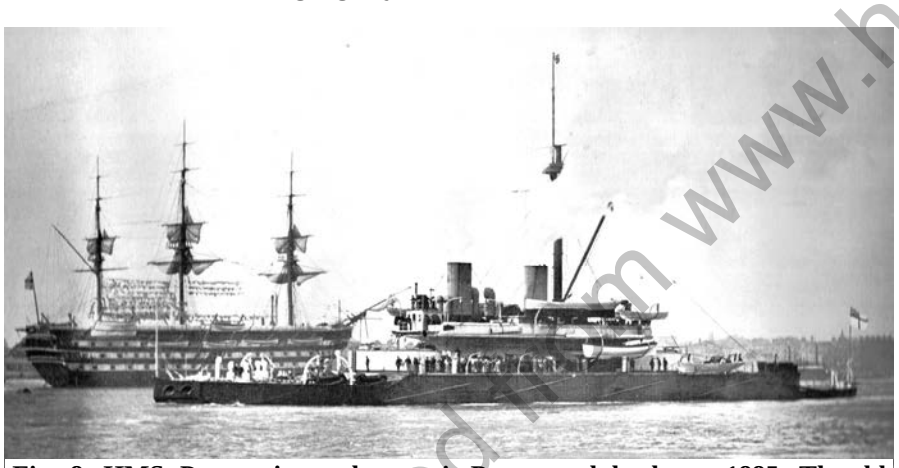


Fig. 8. HMS *Devastation* under way in Portsmouth harbour c1885. The old three-decker is the boys' training ship *St Vincent*.

In spite of such fears, *Devastation* as a seagoing battleship proved a resounding success. Although representing the triumph of defence over offence, critics described her as a "you can't hurt me and I can't hurt you" ship. She was re-armed with breech-loaders, cylindrical boilers and triple-expansion engines when reconstructed between 1891 and 1893.

Cruising Ships *(1): **Shah** (1873-1926)* The iron-hulled unarmoured frigate *Shah* could claim a number of distinctions: the last British sailing frigate – indeed the last British frigate until the category was reintroduced in World War II – and the largest square-rigged British cruiser ever. She is best remembered however as the first British warship to fight an armoured adversary and the only one for the next 37 years.



Fig. 9. HMS *Shah*.

Laid down in 1870 as the *Blonde*, she was renamed when launched (9 September 1873) to honour Shah Nasr-ed-din, then an official guest in London [3]. The displacement was 6250 ton on dimensions of 335 ft (102 m) length between perpendiculars, by 52 ft (15.8 m) beam, by 24 ft 6 in (7.5 m) mean draught. The iron hull was completely cased in two three inch (76 mm) layers of teak and was coppered at and below waterline. A full ship rig and hoisting screw made her one of the fastest ships afloat under sail (13.5 kts). In action, her safety lay in speed – at 16 knots she was also among the fastest steamers - as she could never hope to engage an armoured ship with success.

The armament reflected this point. A large number of medium-calibre guns:- sixteen 7 inch (178 mm) MLR, eight 6 in (152 mm) MLR,- were for use against cruisers, where the number of hits was believed to be more important than the weight of shells. The heaviest weapons, two 9 in (229 mm) MLR, were fitted as upper deck chase guns, one firing ahead, one astern.

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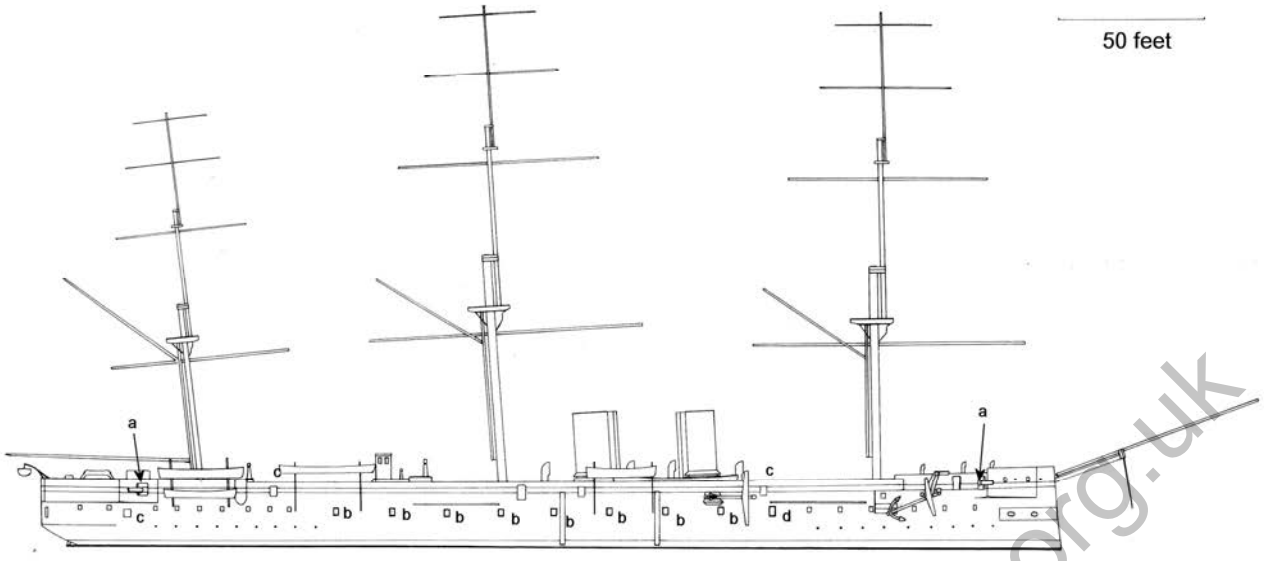


Fig. 10. Line drawing of HMS *Shah*, to show armament. (a) 9in (229mm) 12-ton MLR; (b) 7in (178mm) 6.5-ton MLR; (c) 6in (152mm) 64-pdr MLR; (d) torpedo launcher (port and starboard).

Once complete, the *Shah* was assigned as flagship to the remote Pacific station, stretching from British Columbia to Cape Horn. As the Esquimalt naval base was some years in the future, British ships were docked at San Francisco, international relations permitting. The station included several volatile Latin American republics with small armoured ships, and British interests had hitherto been represented by an ironclad. In May 1879 the crew of the Peruvian turret ship *Huascar* [4] mutinied and, embarking a rival to the incumbent president, began an adventurous career along the coast, levying fines on ports, 'requisitioning' supplies from foreign ships and interfering with Her Majesty's mails. The government in Lima declared her a pirate and requested foreign assistance.

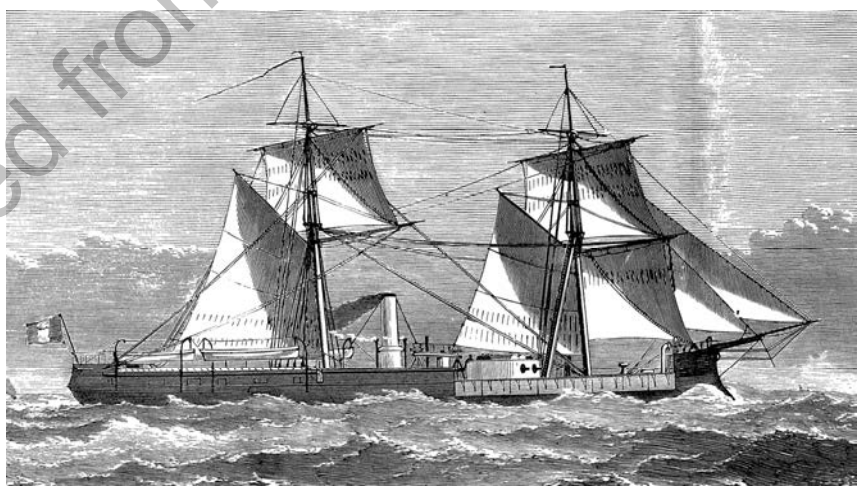


Fig. 11. Contemporary engraving of *Huascar*.

On 28 May, *Huascar* brushed aside the remaining Peruvian ships at Ylo. The *Shah*, flying the flag of Rear-Admiral Algernon de Horsey, reached the scene next day and, with the corvette *Amethyst*, brought *Huascar* to action. The British flagship was much faster but less manoeuvrable and of far deeper draught. Her guns, according to statistical lists and proving-ground trials, could pierce the ironclad's armour. In a two-hour encounter, the battle of Pacocha, at ranges seldom exceeding a mile (1600 m), the British ships fired over 400 rounds (*Shah* 237 rounds, *Amethyst* 190 rounds), making 70-80 hits, none of which seriously troubled *Huascar*; her armour was scarcely affected. The 3.5 in (89 mm) of iron was pierced once, the shell bursting in the backing, while a 7 in shell made a 3 in [76 mm] dent in the 5.5 in (140 mm) turret face. *Huascar*'s return fire, probably only a handful of rounds (*Shah*'s log recorded only five firings) from the two turret guns, was even less effective, making three near misses; she was disadvantaged as the turret took 15 minutes for one complete rotation, needing 16 men. The ironclad could herself make a complete circle in under five minutes and had a formidable ram. This and the presence of shoals prevented the *Shah* from closing, while the houses of Ylo close behind the Peruvian ship inhibited British fire.

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The action saw the first operational use of the Whitehead torpedo. *Shah* fired one at a range of only 400 yards (366 m) just as *Huascar* turned stern on. The ironclad was about two knots faster than its pursuer, the track of which was followed for about half the distance. Attempts that night to use spar torpedoes from a picket boat and another Whitehead dropped from a cutter failed when *Huascar* could not be found. Next morning the pirate surrendered to the Peruvian navy, the recent rebel suggesting to the loyalist commander that they join forces against the Anglo-Saxon intruders!

The *Shah* was hurriedly replaced in the Pacific by the ironclad *Triumph* and went into reserve on her return. She was never recommissioned, becoming a depot ship in Bermuda in 1892 with guns, machinery and rig removed, and a coal hulk in 1919. She was wrecked in 1926. De Horsey was also unfortunate, his career falling foul of domestic party politics because of the *Huascar* fiasco. He was only briefly employed again at sea and was passed over for final promotion to the rank of Admiral of the Fleet [5].



Fig. 12. HMS *Inflexible* at Portsmouth.

Devastation to Colossus The *Devastation* type was quickly eclipsed by the citadel ship. The first of these, the Italian *Duilio*, was two knots faster than *Devastation*, had far heavier guns [100 ton 17.7 in (450 mm) MLR against 35-ton 12 in (305 mm) MLR] and thicker armour of 21 in (533 mm) maximum thickness against 14 in (356 mm), although the armour protected much less of the hull. The overall superiority of the *Duilio* was nevertheless clear. An improved version, HMS *Inflexible*, was promptly laid down at Portsmouth and completed before the Italian ship. *Inflexible* carried the heaviest MLR at 80 ton, 16 in (406 mm) calibre and the thickest armour, a maximum of 24 in (610 mm) wrought iron, ever put afloat in a British ship. She set new records for the Royal Navy in size (11 880 ton) and cost (£812 485).

The *Colossus* (1882-1906), the second Portsmouth-built citadel ship, was considerably smaller and cheaper than *Inflexible* but introduced major advances. Steel was used for general construction, only heavy forgings such as the stem being iron, while 45 ton 12 in (305 mm) breech-loading guns (BLR) replaced the ponderous muzzle-loaders, and compound armour replaced the wrought iron on the ship's side. Layout was unchanged, armour and armament being concentrated amidships in the central 'citadel' with the big guns in turrets placed diagonally on opposite sides of the ship (port turret forward, starboard aft). This *en echelon* arrangement meant that, in principle, all four heavy guns could fire straight ahead; ideal when ramming an enemy. Broadside fire was less satisfactory, as cross-deck arcs were limited and would inflict blast damage on the superstructure. In reality, end-on and cross-deck fire was only for emergencies, when damage could be accepted. Seymour noted that when an after turret gun in *Inflexible* was fired, with a reduced charge, forward at 15 degrees to the centre line, the fore turret and conning tower were rendered untenable.

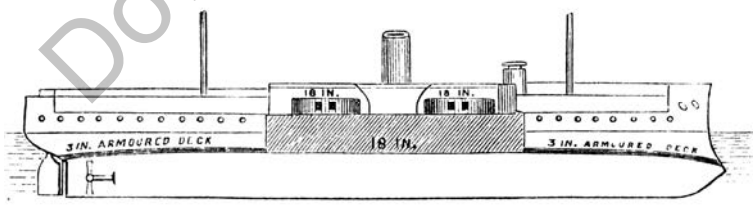


Fig. 13. Diagram showing disposition of armour and armoured deck in HMS *Colossus* (1882), twin-screw double-turret citadel battleship 1st class, with unarmoured ends but armoured deck. 9420 t, 7500 ihp, 4-12in (305mm) 45-ton BLR, two in each turret.

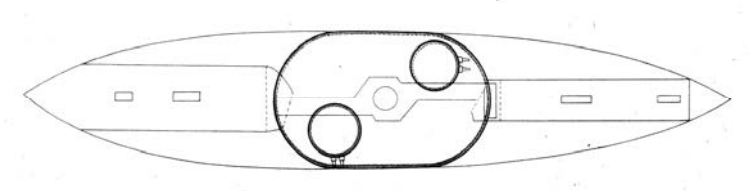


Fig.14. Simplified plan view of *Colossus*. Four guns could fire straight ahead in line with the keel, but only two directly aft, as the poop was wider than the forecastle. The poop was officers' country, and it was considered unlikely a British battleship would show its stern to an enemy.

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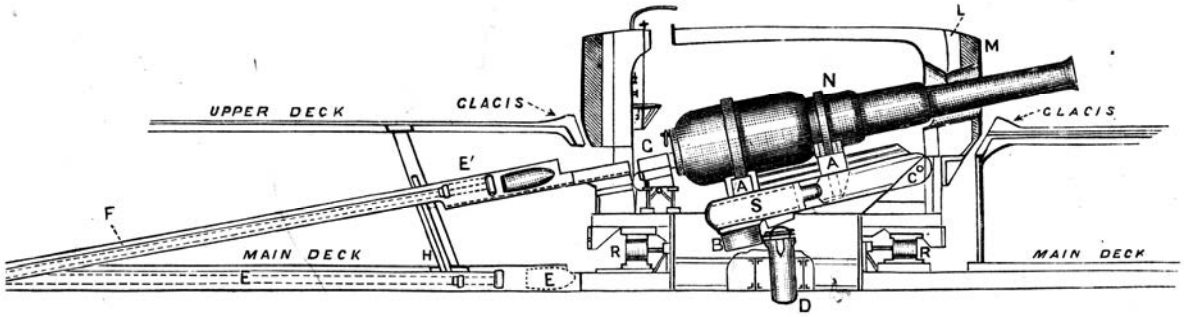


Fig. 15. Section of turret, HMS *Colossus*. Key: (A) saddle on which the gun is fixed; (B) recoil press; (S) slide; (C) pivot of slide; (D) elevating cylinder; (E) loading trough; (F) rammer; (G) hydraulic arrangement for working breech-block; (H) ram for raising rammer and shot; (L) teak backing; (M) 18-inch (457mm) armour; (N) the gun (45-ton breech-loader). To load, the projectile is placed in a trough (E) on the deck; the trough is raised by a ram (H) until it is in the required position (E') for loading; a rammer (F) then passing up the trough forces the projectile into the gun; on the trough being lowered, the cartridge is placed in it and rammed home in a similar manner.

Cruising Ships (2): *Calliope* (1884-1951) The steel-hulled *Calliope* with her sister *Calypso*, the last British sailing corvettes, were of improved *Comus* type, being ten feet longer to allow for additional boilers and two extra gun-ports. In effect a diminutive and updated *Shah*, she was launched in the Dockyard on 24 July 1884. She displaced 2770 tons on dimensions 235 ft (pp) x 44 ft 6 in x 19 ft 11 in (max) (71.6 m x 13.6 m x 6.1 m). As in *Shah*, the hull was timber-cased and coppered. The armament comprised four 6 in (152 mm) BLR in sponsons, twelve 5 in (127 mm) BLR in the waist and six Nordenfelt machine guns.

The *Comus* class had introduced protection to British cruisers in the shape of the partial protective deck. In *Calliope* it was 103 ft (31.4 m) long, 1.5 in (38 mm) thick and extended from side to side about four feet (1.2 m) below the waterline, covering the machinery spaces and the magazine. Coal bunkers above and below the deck provided, when full, extra protection against shells. Six feet (1.8 m) of coal was taken as equivalent to three inches (76 mm) of iron. A single screw and robust machinery gave a trial speed of 14.74 knots with 4023 ihp. The ship also carried a heavy barque rig. In short, the *Calliope* was a standard mid-1880s cruising ship for detached service, of a type rapidly made obsolete by quick-firing guns and much faster second-class cruisers.



Fig. 16. HMS *Calliope*

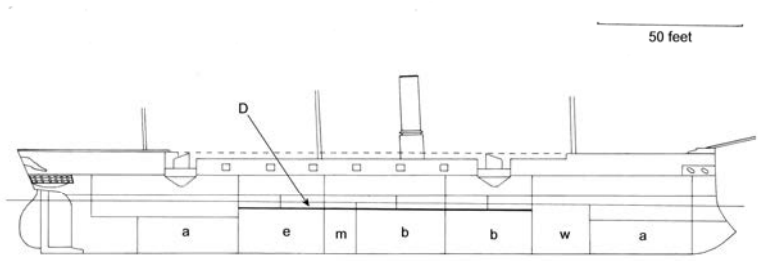


Fig. 17. Diagram of the internal arrangements of HMS *Calliope*. (a) stores, shells etc; (b) boilers & coals; (D) protective deck; (e) engines & coals; (m) magazine & coals; (w) water & provisions.

In March 1889, tribal conflicts and the pressures of would-be colonising powers [6] led to a major crisis in Samoa and to the presence of three German and three American warships in Apia harbour. HMS *Calliope*, Captain Henry C. Kane,

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RN, represented British interests. With barometers suggesting the approach of a violent storm, the ships should have sought the comparative safety of the open sea. Considerations of national prestige meant that each navy watched the others, awaiting the first signal. None came before the storm hit the crowded, unsheltered, reef-strewn anchorage. As the wind increased to hurricane force and waves grew heavier, anchors dragged and ships collided. In the teeth of the wind, Kane decided to take the *Calliope* out of the anchorage, at a speed sometimes as low as 0.5 knots [7]. The *Calliope* collided twice with USS *Vandalia* on the way out, narrowly missed the US flagship *Trenton* and reached safety with a sprung foreyard, head and stem damaged and all boats except one lost. One seaman was seriously injured. When she returned to the harbour, it was to find the other warships ashore, wrecked or sunk, and over 200 American and German sailors dead.

The *Calliope* left active service in 1907, becoming the stationary RNVR drill ship on the Tyne until scrapped in 1951. She was rechristened *Helicon* between 1915 and 1932 to release her name for a new cruiser [8].

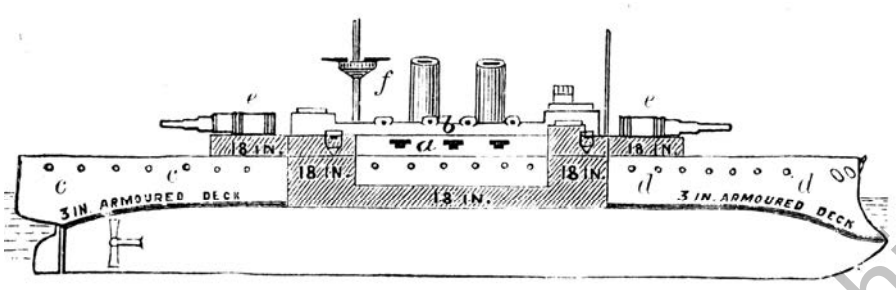


Fig. 18. Diagram showing armour disposition in HMS *Camperdown* (1885), twin-screw barbette battleship, 1st class. 10,600 tons, 11,500ihp, (e) 4-13.5in (343mm) 67-ton BLR mounted in pairs in the barbettes; (a) 6-6in (152mm) BLR in central unarmoured battery; (b) spar-deck with quick-firing guns; (c) officers' quarters; (d) men's quarters; (f) fighting top, armed with 2-6pdr quick-firing guns.

Colossus to Majestic The *Colossus* was the last British citadel ship. The next class, the 'Admirals', six ships in four sub-groups, returned to the earlier *Devastation* layout, but abandoned the closed turret. Freeboard was once more low, but the big guns were *en barbette*, firing over the tops of raised pear-shaped armoured enclosures which contained loading, training and elevating machinery. They were 23 feet (7.0 m) above water, against 15 feet (4.6 m) in turret ships, so less affected by incoming waves and spray from head seas. Both guns and gun-crews were protected from enemy shells except at the moment of firing. *Camperdown* of this class was built at Portsmouth. Naval opinion considered the 'Admirals' poorly protected. A reaction set in, and *Trafalgar*, the next Portsmouth battleship, launched three years later, was an enlarged and updated *Devastation*, very comprehensively armoured but again with low freeboard and turrets close to the water. An armoured central battery was reintroduced for the secondary armament, four 4.7 in (120 mm) quick-firing guns on each beam. Neither *Camperdown* nor *Trafalgar* was the definitive battleship.



Fig. 19. HMS *Trafalgar*.

The *Royal Sovereign* class, built under the Naval Defence Act (1889), was given extra displacement to combine 'Admiral'-type barbettes with good protection and the high freeboard essential for working guns and maintaining speed at sea. They set a new standard for the navies of the world. The *Royal Sovereign* herself was the second Portsmouth-built armoured ship of the name. The Naval Defence Act spurred battleship construction in France and Russia, and to maintain Britain's 'Two Powers Standard' (to be 10% stronger at sea than the next two navies combined), nine first-class ships, the most numerous British battleship class, were provided under the 1893 Spencer Programme.

The *Majestic* (1895-1915), the first of the nine, was launched at Portsmouth on 31 January 1895. She carried four twelve-inch (305 mm) guns of new wire-wound construction in twin barbettes fore and aft, barbettes and guns being covered by armoured gunhouses. Twelve six-inch (152 mm) quick-firing (QF) guns were

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mounted singly in 6 in armoured boxes (casemates), four on the upper deck and eight on the main deck. Sixteen 12-pdr (3 in, 76 mm) QF were in the hull fore and aft and in an unprotected battery amidships. The twelve 3-pdr (47 mm) QF went in the four fighting tops on the masts. In all, forty-four guns in four different sizes were carried, together with five torpedo tubes. The protective deck reinforced the armour belt, which was of nickel steel hardened by the Harvey process.

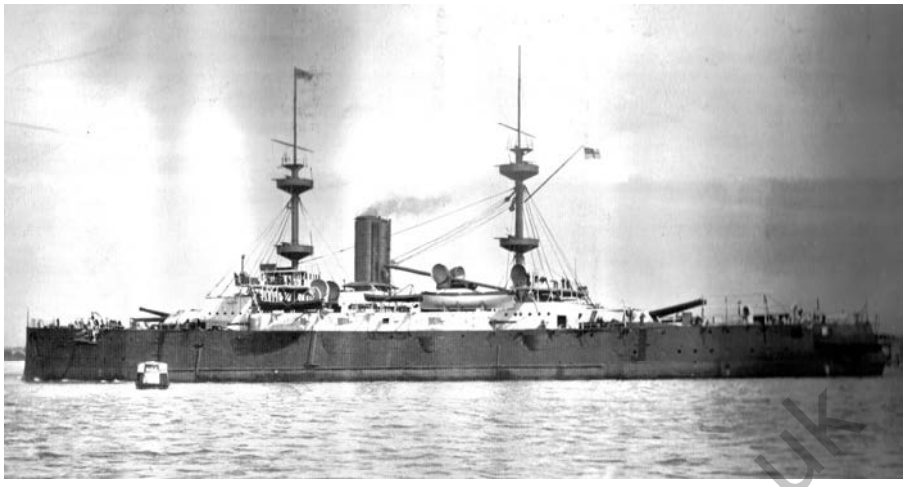


Fig. 20. HMS *Majestic*.

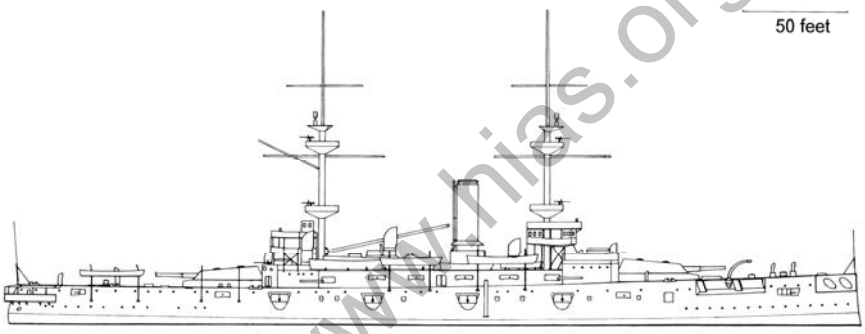


Fig. 21. Line drawing of HMS *Majestic*.

There was keen rivalry between Portsmouth and Chatham Dockyard, where the second ship, the *Magnificent,* was building. The race was becoming close when the *Magnificent* gained a lead from delivery of armour plates which, according to Lord Charles Beresford, Captain of the Dockyard at Chatham, might have gone to the *Majestic*. It was generally held that "should" gave a more truthful picture than "might". In general terms the *Majestic* served as a pattern for successive battleship classes up to the *Dreadnought.* Two more of the class, *Prince George* and *Caesar,* were also built at Portsmouth. They were handsome and symmetrical ships with marked sheer and funnels close abreast. *Majestic* was the premier British flagship, heading the Channel Fleet from 1895 to 1904 (*Magnificent* was second flagship), before serving in the Atlantic and, later, the Home, Fleet. Sent to the Dardanelles in 1915, she was torpedoed twice by U-21 off Gaba Tepe on 27 May 1915 and sank in seven minutes with the loss of forty lives.

Cruising Ships (3): *Gladiator* (1896-1909) In ancient Rome, saints suffered at the hands of gladiators; on one occasion at sea, roles were reversed. HMS *Gladiator,* one of four second-class cruisers (the others were *Arrogant, Furious* and *Vindictive*) for fleet service, was launched in the dockyard on 8 December 1896. Probably the last major warships with a serious role as rams, the *Arrogants* were 35 feet shorter than the preceding *Eclipse* class, with reinforced bows having 2 in (51 mm) steel plating on the hull and a strengthened and more prominent ram, and

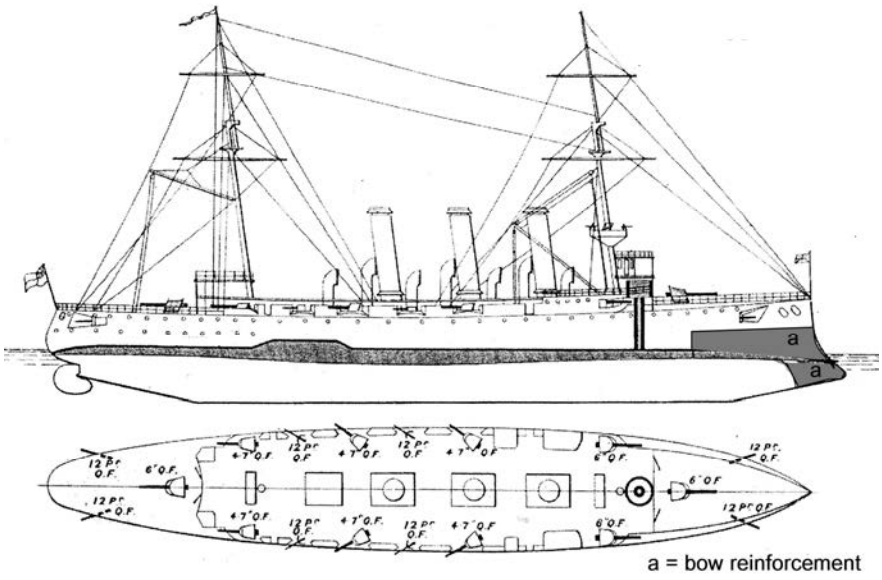


Fig. 22. Drawings of HMS *Gladiator* (Brassey).

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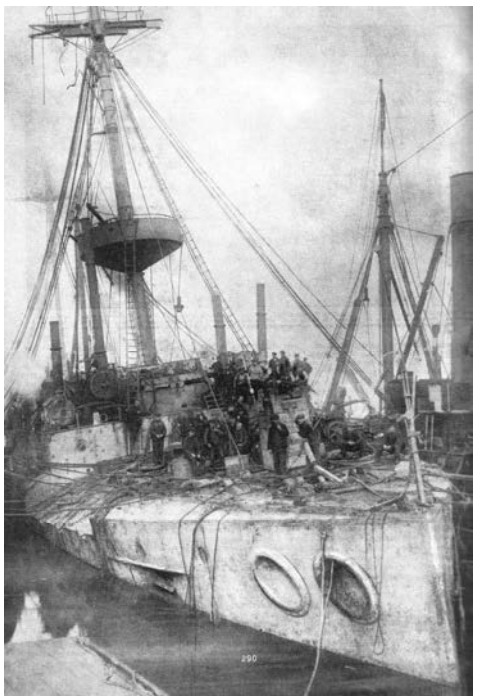


Fig. 23. Wreck of HMS *Glaadiator*.

thicker conning tower plating. The reduced length made them handy ships, good for ramming, but caused their speed to fall off rapidly in a seaway. The original weak mixed armament of four 6 in (152 mm) and six 4.7in (127 mm) quick firers was changed to a uniform ten 6 in QF between 1902 and 1905.

As a guest of the Channel Fleet, Rudyard Kipling observed *Arrogant* and *Furious* on manoeuvres. "'Does that ship (*Arrogant*) always behave like that?' I asked. From all three funnels of a high stubby cruiser, the smoke of a London factory insulted the clean air. 'Oh, no; she's only burning muckings [9] like the rest of us. She's our "chummy" ship. She's a new type – she and the *Furious*. Fleet rams they call 'em. Rather like porcupines, aren't they?' The two had an air of bristling, hog-backed ferocity strangely out of keeping with the normal reserve of a man-of-war".

At about 1430 on 25 April 1908, in a heavy snowstorm and at the tail end of a NW gale, *Gladiator* was steaming past Fort Victoria at 9-10 kts, inbound. The 11 629 grt American Lines passenger ship *St. Paul*, making for the Needles passage, was not seen approaching until about 200 yards (183 m) distant. Despite frantic warnings, the liner's bow struck a heavy oblique blow about level with *Gladiator*'s third funnel, shearing away 50 feet (15.3 m) of the cruiser's side over the coal bunkers, from upper deck to well below the waterline. The stricken ship was beached, heeling over as she reached the shore to end up on her side on a shingle bank near Yarmouth Pier. 27 lives were lost.

Five months and considerable effort went into salvage. Much of the hull was above water; it was first lightened, pulled bodily into shallower water and then made watertight before being brought upright. Taken into Portsmouth for detailed examination, the ship was – not surprisingly – deemed beyond economic repair and scrapped. The career of her sister *Vindictive* would end in fame rather than ignominy; after serving as assault ship in the attack on the mole at Zeebrugge, she was scuttled at Ostend as a blockship (April and May 1918). *St. Paul* was repaired and returned to service [10].

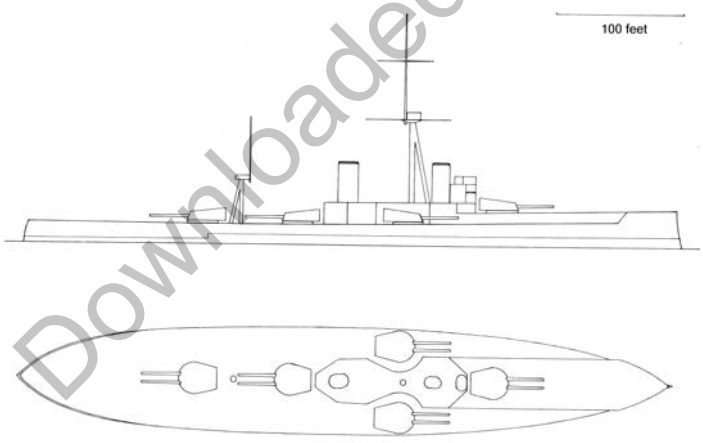


Fig. 24. Schematic plan and elevation of HMS *Dreadnought*.

Dreadnoughts and Superdreadnoughts

Britain followed the *Majestic* class with thirty generally similar battleships in six classes, spread over ten years, each class introducing small improvements - longer guns, tougher armour, better armour distribution, water-tube boilers. Of the thirty, *Canopus, Formidable, London, New Zealand* and *Britannia* were built at Portsmouth. The slow tempo of development accelerated abruptly with the appointment (21 October 1904) of Sir John Fisher as First Sea Lord. In December 1905 the revolutionary *Dreadnought* (1906-22) was begun at Portsmouth, introducing single-calibre main armament for salvo firing; her ten 12 inch (305 mm) guns were backed only by light anti-torpedo quick-firers, the secondary armament being abolished. She could fire eight guns on the beam or six ahead, against four or two respectively for earlier ships such as *Majestic*. The demand for effective salvo firing was linked to innovations in fire control systems. Her second major feature was propulsion by Parsons turbines, giving a three-knot advantage in speed over existing battleships. This enabled the *Dreadnought* to choose whether to run or fight, and also to fix battle range and tactics. By making earlier battleships obsolete, she nullified Britain's huge advantage at sea – *Majestic* went from being a first-class battleship to a lowly 'pre-*Dreadnought*' – and the naval arms

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race started again from scratch. The *Dreadnought* was built in a legendary year and a day – in fact from keel laying to preliminary trials, not completion – to make the point that Britain could, and if necessary would, out-build her rivals in the new type of battleship.

Thirty-one British *Dreadnought* and *Superdreadnought* [gun calibre 13.5 in (343 mm) or greater] battleships followed the eponymous prototype on the stocks between 1906 and 1914, eight (*Bellerophon, St Vincent, Neptune, Orion, King George V, Iron Duke, Queen Elizabeth, Royal Sovereign*) at Portsmouth. Each Portsmouth ship gave its name to a new and more powerful class as Anglo-German rivalry was reflected in accelerating size, gun power and protection. For instance, while *Dreadnought* was about 20% larger than the Naval Defence Act battleships of 1889, the seven years from *Dreadnought* to *Queen Elizabeth* saw a 50% increase in displacement, from 17 900 tons to 27 500 tons. *Queen Elizabeth* (1913-48), the lead ship of five, was the largest and best British battleship design of World War 1. The increase in displacement from the 25 000 t *Iron Duke* was used to introduce the very successful 15 inch (381 mm) gun and, as four 15 in turrets would fire heavier broadsides than the five 13.5 in turrets in the earlier ship, the fifth turret space was used to double boiler power, for a three knot speed advantage with oil fuel replacing coal. Special arrangements were needed for the oil bunkers, many 30 ft (9.2 m) in height and requiring special construction to withstand the head of oil. She went to the Dardanelles on completion, but, exposed to torpedoes and mines and with guns ineffective against land targets, soon returned to home waters. Refitting at the time of Jutland, she replaced *Iron Duke* as Grand Fleet flagship from 1916 to 1919. Whereas the last battleship built at Portsmouth was the *Royal Sovereign*, a better protected but smaller (25 750 t) and slower *Queen Elizabeth*, the last battleship actually ordered from the dockyard was the *Agincourt* of the 1914-15 Programme. This ship, intended as the sixth [11] and last *Queen Elizabeth*, was cancelled on 26 August 1914, just after the outbreak of war; the keel had not been laid, and the proposed name had already been assigned to a battleship seized from Turkey.

Notes:

1. Coles had placed a cannon on the raft *Lady Nancy* in the Crimean War, and the Admiralty tested his turret in *Trusty* (1860); Ericsson presented a turret ship design to Napoleon III, to Palmerston and Whitehall "the Crafty Spider of the Tuileries", in 1854, and completed the little *Monitor* in early 1862.
2. 9 March 1862. In a drawn battle, Ericsson's *Monitor*, 2 guns, checked the depredations of the Confederate ironclad *Virginia* (ex-USS *Merrimack*), a frigate conversion with ten guns in a single armoured casemate.
3. The Shah's gilded signature in Persian on the ship's stern was initially upside down. A Briton formerly in Teheran remarked that if perpetrated in Persia the person responsible would have been shortened by a head.
4. 2032 tons, 2-10in MLR in Coles turret, 5.5in-3.5in armour, 12 knots.
5. In 1892, the only Victorian flag officer so treated on reaching the top of the Admirals' list. He met all service requirements for advancement.
6. German attempts to annex Samoa (most traders were German) were opposed by the United States, with Britain less directly concerned. Of the three powers, Britain had acquired Fiji (1874), Germany edged Spain out of the Marshall Islands (1885) and the United States leased Pearl Harbor in 1887. The tripartite administration proposed for Samoa in 1887 was upset in early 1889 by local German action (later disavowed by Berlin) but was implemented after the hurricane. Tribal disputes again escalated in 1898-99 and the islands were divided between Germany and the United States.
7. Rear-Admiral Kimberly in *Trenton* estimated 4 cables – 800 yards – in two hours.
8. *Calypso* was the naval reserve drill ship in Newfoundland between 1902 and 1922 and then a storage hulk. Her half-sunken remains may still be seen just offshore at Embree, near Lewisporte. For details and recent photos enter 'HMS Calypso Newfoundland' into Google.
9. Grease and dirt.
10. On 25 April 1918, ten years to the day after the disaster in the Solent, the *St Paul* capsized at New York while converting to a troopship (*Knoxville*). She was refloated and repaired for further service before being scrapped in 1923.
11. The failure in the Canadian Senate (May 1913) of the Naval Aid Bill, which would have provided three *Queen Elizabeth*s at Canada's expense, had ruled out the Admiralty's ultimate goal of a wing of eight fast ships.

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Southampton International Airport, 1910-1946

Jeff Pain



Fig. 25. Eric Rowland Moon and helpers with his aircraft *Moonbeam 2*.
Note the houses of Campbell Road in the background.

This year sees the centenary of the first powered aeroplane flight from the area of Southampton Airport, by Eric Rowland Moon who designed and built *Moonbeam 2*. He had started a manufacturing company called Moonbeams Ltd which continued as the Canute Aircraft Factory until the end of the First World War. At one stage, it was located in the Wool House in Southampton. Moon himself joined the Royal Navy as a pilot fighting the Germans in East Africa. During this time he was captured but quickly escaped and returned to duty. Having been absorbed into the RAF at its formation on the 1st April 1918, he remained with the service after the war as a Squadron Leader. Unfortunately, he was killed in 1920 whilst flying a *Felixstowe F5* flying boat and is buried in Southampton Old Cemetery.

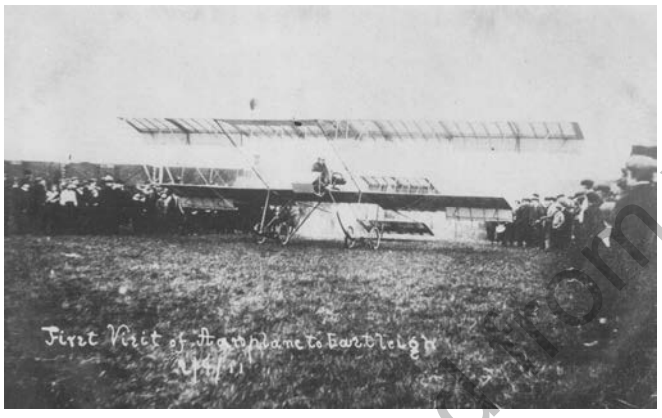


Fig. 26. Though not mentioned, this must be Maurice Tetard with his Bristol *Boxkite* and a large crowd of interested onlookers. Note the railway wagons in the left background.

The next use of the airfield was by a Frenchman, Maurice Tetard, on the 2nd April 1911. Flying a Bristol *Boxkite*, he lost his way heading for Salisbury plain, landed for directions and, being pointed in the right direction, left shortly afterwards. About this time, several early aviators passed nearby, including Colonel S. F. Cody and Claude Graham-White, also M. Beaumont whilst winning the 1911 round-Britain air race.

Also in 1911, an Eastleigh man, R. H. Eggleton, with a group of friends began building a series of eleven gliders, of which a few flew successfully from a field at North End near Fleming Park. They were reputedly intending to move into powered flight experiments but the outbreak of war in 1914 prevented further activities.

The next big event for the site was a display given by Gustav Hamel in his Morain Saulnier monoplane on 9th May 1914. He performed aerobatics including 'looping the loop' and the 'celebrated tail dive'. To round off the proceedings, two very lucky programme winners, a Mr T. A. Stubbs of Bishops Waltham and a Miss Irene Thompson of Shirley Road, were given flights.

One last event before the outbreak of war was on August Bank Holiday (01/08/1914) when Mr B. C. Hucks, flying his 80 hp Bleriot monoplane in front of a vast crowd, gave a superb aerobatic display including a 'whip top twizzle', dutch plane, spiral volplanes, steeple chasing, steep banking, side-slip recovery and 'looping the loop'.

During the war, although there was an RFC store on what later became the Pirelli factory in Leigh Road, the only flying was by the commandant who had an aeroplane for his personal use. No interest was taken in the airfield site until 1917 when the RFC were looking for a UK aircraft acceptance base which was out of range of German bombers but within the range of our bases in France. They selected Eastleigh and work to prepare the site commenced in early 1918.

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At this time, the aircraft division of the United States Navy who were responsible for offence, i.e. bombing activities (the Army looked after spotting and defence) was seeking premises with the same parameters. It had to be close to a major port to receive crated airframes and engines from the USA, assemble them and fly them to operational bases in France. The RAF (formed 01/04/1918) offered the half-completed station at Eastleigh and the USN took over on the 20th July 1918, the site becoming operational in October.

As the supply of material from the USA was not yet fully organised, supplies of DH4, DH6 and DH9 airframes obtained in the UK and fitted with American engines were assembled and flown to active squadrons. Repairs and maintenance work were carried out on existing aircraft. However, the base was destined to have a short but busy life with the war ending on the 11th November 1918. All work stopped four days later, most of the personnel were repatriated fairly quickly and, after disposal of equipment and stores, the site was handed back to the RAF who used it for disbanding surplus squadrons until it closed in May 1920.

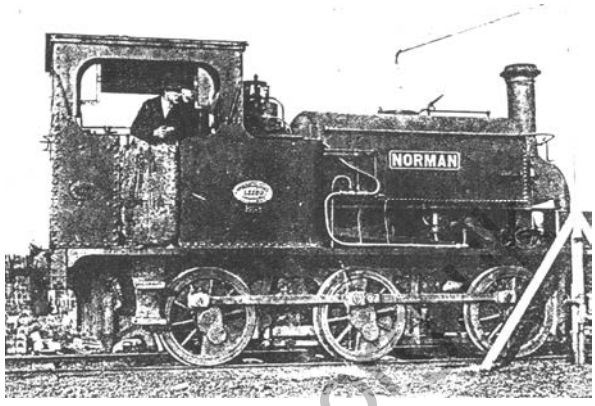


Fig. 27.To work the 1918 railway sidings *Norman*, an 0-6-0 ST built by the Hunslet Engine Co. (N0. 454 of 1888) was used.

In late 1921, a consortium of shipping companies formed a company under the title Atlantic Park which opened the site in May 1922. The buildings were used as hostels to assembles and process refugees emigrating from Europe to the New World. This continued until March 1931 (see *HIAS Journal* No.**14**, 2006) when the site was again mothballed.

During the 1920s, although officially closed, the airfield still saw a fair amount of use, particularly by Surrey Flying Services who took some 3600 people on pleasure flights. R. J. Mitchell flew his '*Sparrow*' light aircraft from the field (this being his only land-operated aircraft before the development of the *Spitfire*). Other uses included the short-lived Southampton Glider Club in 1931. Later in that year Captain Barnard's Air Circus performed in front of a large crowd.

By the late 1920s there was a movement throughout the country for the development of aviation; many towns and cities investigated having their own airports and Southampton was no exception. In view of the existing connection with flying boat services, some thought was given to a joint sea and land facility but no suitable site was found. So, in 1929 they turned to the obvious location and the Corporation purchased the airfield but not the buildings as they were still in use as Atlantic Park.

Purchase of the buildings was completed in January 1933 and work commenced to complete a municipal airport. An event which helped arouse local interest was the visit by Sir Alan Cobham and his famous 'Flying Circus'. The attractiveness of the site was confirmed by the Hampshire Aeroplane Club transferring from Hamble and Vickers Armstrong Ltd (by then the owners of Supermarine), who were looking for an aircraft flight testing site, obtaining government approval to use the airfield.



Fig. 28. De Havilland *Gypsy Moths* G-AAEW and G-ABEK of the Hampshire Aeroplane Club warming up their engines.

The first commercial user of the new airport would appear to be Provincial Airways with a service from Croydon to Plymouth calling at Southampton and other points en route. Interestingly, in December 1933 they started an airmail service but, unfortunately, they did not have Post Office approval, so the service only operated for a few days. In 1935, Railway Air Services ran an airmail service but this failed after a few months.

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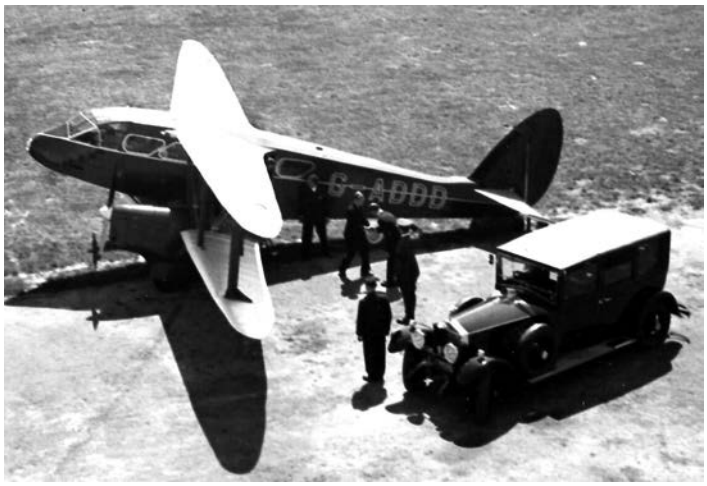


Fig. 29. De Havilland *Dragon* G-ADDD of the Royal Flight with the Duke and Duchess of Kent disembarking.

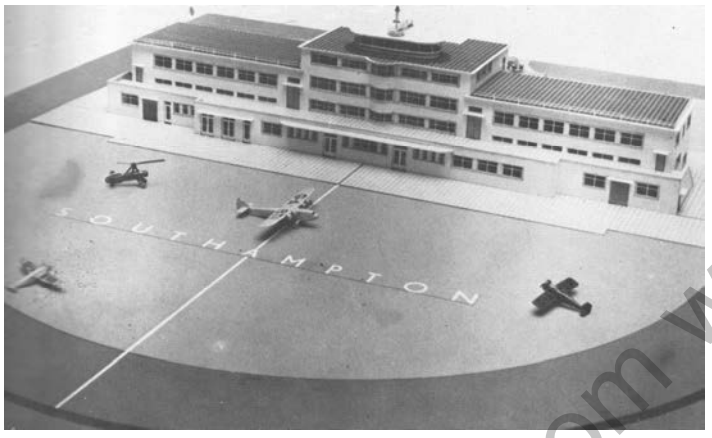


Fig. 30. Model of a proposed terminal complete with Dinky Toy aircraft.

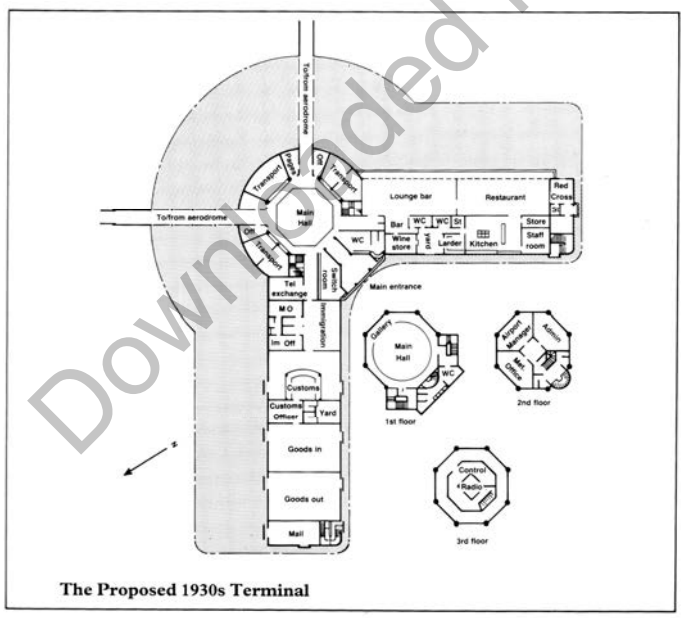


Fig. 31. Plan of proposed terminal facility with central control tower and covered walkways to aircraft. The design bears a strong similarity to the 'Beehive' terminal at Gatwick.

At the end of 1933, Jersey Airlines extended their service from Portsmouth to Southampton and, within two years, Southampton became their main terminal in the area. Railway Air Services linked Bristol, Birmingham and Cowes via Southampton, with connections to Manchester, Liverpool, Leeds, Belfast and Cardiff. Smaller companies established services to other destinations including Hull. It is of interest to note that, at one stage, Southampton was the fourth busiest airport in the UK after Croydon, Heston and Liverpool.

In 1935, an area in the north east corner was leased to the Air Ministry for a joint RAF/AA reconditioning base called 'RAF Eastleigh'. This was renamed 'RAF Southampton' in August 1936 and later, in July 1939, became 'HMS Raven' which the Germans claimed to have sunk during the war.. With the outbreak of war imminent, control of the airfield was taken over on 2nd September 1939. This lasted until April 1946 when it was handed back for full civilian use, although scheduled passenger flights had restarted on the 10th September 1945.

There were several proposals to improve passenger facilities, including at least two schemes for very grand terminal buildings. However, it was to be over sixty years before any positive development took place. One anachronism was that, although night landing lights had been installed, radio had not! The procedure, when required (usually low cloud), was for the incoming aircraft to radio Portsmouth Airport who then telephoned Southampton who would listen for the aeroplane and report to advise instructions for the pilot, until he could descend and achieve visual contact. Apparently, even though an average day saw over sixty landings and take-offs, this was the situation until the end of 1936 when radio was installed. This was followed by a direction finding wireless station and, just before the war, the installation of the Lorenz Blind Approach System.

During the 1930s, several companies had manufacturing, assembly and test facilities at the airport, including Supermarine and their owners Vickers Armstrong, plus several small concerns such as Foster Wickner and finally Cunliffe-Owen who moved into their new factory on the south west side just before the war. The factory was intended to assemble

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American-built commercial aircraft. However, with the onset of war it did assemble American-built fighter aircraft such as the *Tomahawk* and the *Aircobra*.



Fig. 32. Aerial view showing the north end in 1936 with the RAF station at the top. Note the railway platform on the down-side only; this was built in Atlantic Park days but no evidence of its use has been found.



Fig. 33. A De Havilland DH 86 of Jersey Airlines on 4th March 1939.
At first glance, you might think these people were passengers about to board (or just landed) though, as this number of people would require at least four aircraft of this type, it is unlikely.

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Fig. 34. Foster Wickner *Wicko* G-AEZZ in 1938.



Fig. 35. The Vickers *Wellington* prototype and an early *Spitfire* photographed in 1938



Fig. 36.
Aerial view looking north in the early 1930s, showing what are mainly the original 1918 buildings.
Note the Vickers Supermarine hangars in the foreground, and the sports field pavilion



Fig. 37.
In May 1939. Test Pilots Quill and Pickering after a demonstration by two *Spitfires* in front of a French delegation. This was, presumably, a sales pitch as there were hopes of selling the aircraft to the French Air Force.

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Fig. 38.
The Cunliffe-Owen factory as new in 1939, looking south east. Though much enlarged, this is now the Ford Transit site. The office block remained unaltered until recently when the fascia has been altered.
Note, top left, the Supermarine test hangar with a *Walrus* on the apron.



Fig. 39.
The only Cunliffe-Owen *Flying Wing* G-AFMB built in 1939. It had been scheduled to operate with Olley Air Services on their London to Dublin route. With the outbreak of war it went to west Africa from where its fate is unknown.

And to end with:

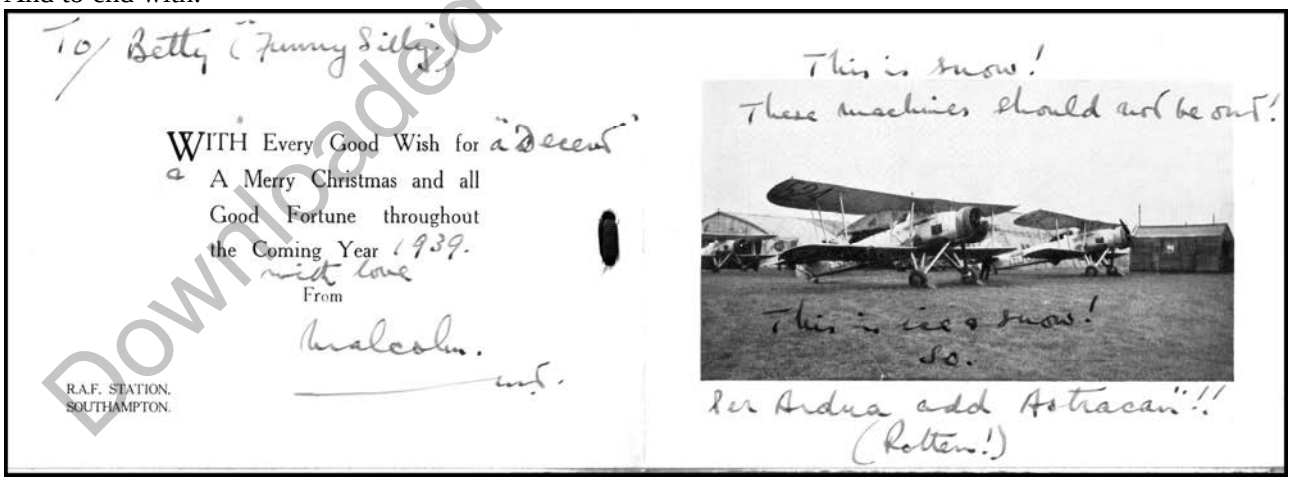


Fig. 40. RAF Southampton Station Christmas card for 1938, complete with dedication and photograph of *Swordfish* aircraft.

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The Southampton Corporation Waterworks at Otterbourne

Martin Gregory

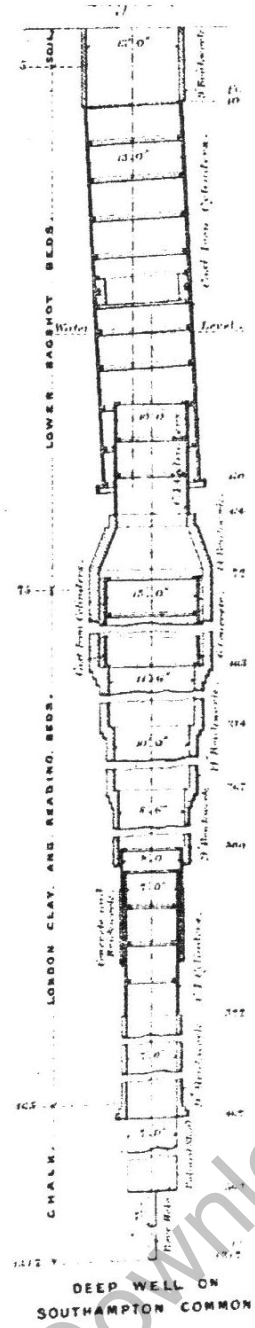


Fig. 41. Cross-section of deep well on Southampton Common.

Right up to the nineteenth century many city-centre houses had their own water supplies from wells adjacent to, or in the basement of, the house. Southampton was no exception, though some limited local supply was first recorded when the Friars Minor of Southampton granted the use of their water supply to some local inhabitants in 1310. A century later, the Friars had insufficient funds to maintain their supply and, on 3rd October 1420, they conveyed their conduit, pipes and other works to the Mayor and Community of Southampton. Since then, centralised water supplies in Southampton have been vested in the Corporation's control up to the creation of the Southern Water Authority in 1974 and the subsequent privatisation of water supplies.

After 1420, nothing much happened for the next four centuries in which no significant centralised supplies were built. In 1804 a small open reservoir was built on Southampton Common behind the Cowherd Inn, to impound springs welling up on the Common (this was backfilled in 1871). Two further small reservoirs were built in 1830 (later a paddling pool) and 1831 (later a boating lake). Permission was given by the Town Council to John Collyer, a local plumber who was one of the Waterworks Commissioners, to sink a well on the Common. A start was made in July 1838 to sink the well, 13 ft (4 m) diameter, but when he had got to 62 ft (19 m) below ground level it was found that the well was 2 ft (0.6 m) out of plumb and the contractor backed out. The project was taken over in 1842 by Mr. Thomas Docwra, a well respected well-sinking contractor. He carried out remedial work on the upper stage and sank the well in stages over many years to 563 ft (172 m) below ground level (Fig. 41). The profile of the well was of 14 ft diameter lined with 14 inches of brickwork and cast iron tube (with concrete between the brick and the iron) down to 164 ft; 11 ft 6 in diameter down to 214 ft; 10 ft diameter down to 267 ft and 8ft 6 in diameter down to 322 ft where the iron tube lining ceased. A 9 in brick lining continued down to 467 ft where chalk was encountered. In the chalk the well was unlined down to 563 ft. At this point, with no usable water supply coming in, a 7 in bore hole was drilled for a further 754 ft to a total depth of 1317 ft (402 m) which was reached in February 1851. The yield was only 130 000 gallons (600 kl) per day so the well was abandoned as the Mansbridge supply had come into use. The well continued to be discussed until 1882 when the project was finally written off. After this expensive failure the Corporation sought sources of water outside the Borough.

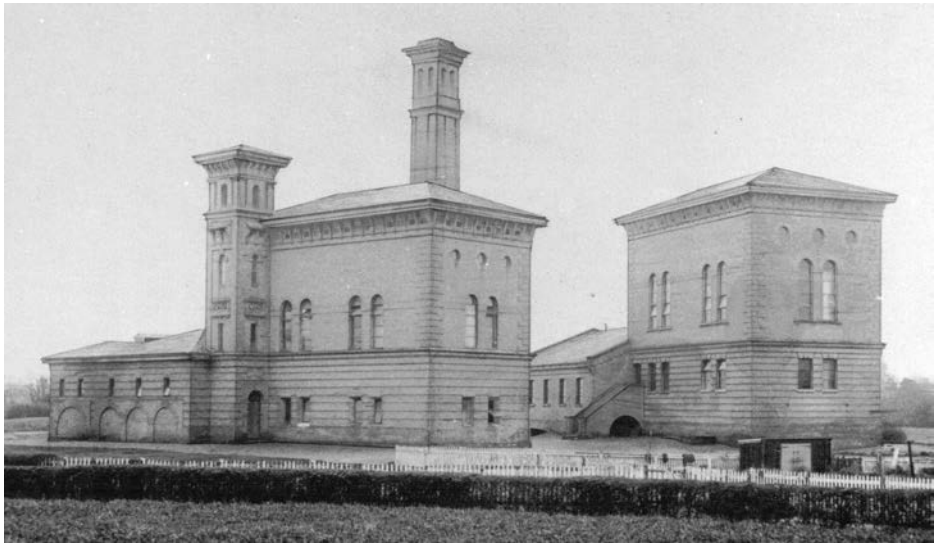


Fig. 42. The pumping station at Mansbridge drawing water from the river Itchen.

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Following Acts of Parliament in 1836 and 1850, the Corporation was empowered to take water from both the river Itchen and the river Test. Water was not taken from the river Test but, in 1851, a pumping station was erected at Mansbridge to pump water from the river Itchen, just above where it became tidal, to two open reservoirs at the north end of the Common. Mansbridge remained the only supply until, under the Southampton Corporation Act of 1885, a start was made on developing a new source of high quality water from wells in the chalk at Otterbourne, eight miles north of the Borough.

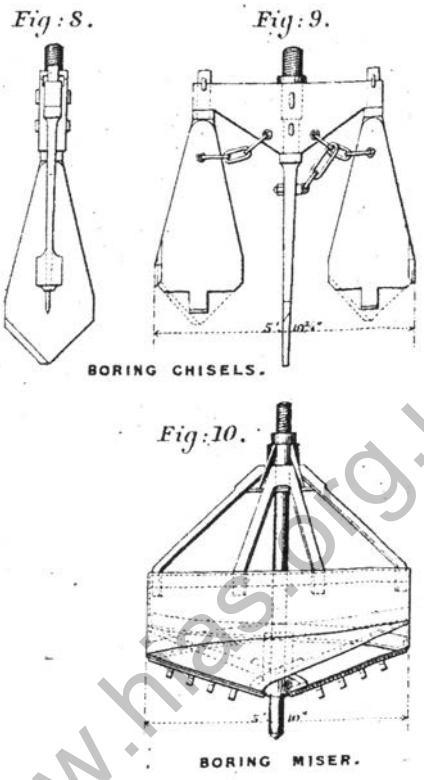


Fig. 43. Well boring tools used at Otterbourne

The aquifers in the chalk underlying the Test and Itchen valleys provide a copious source of high quality hard water. The Winchester Water Company had started their supply from wells in Winchester in the 1850s and the South Hants Water Company had built their first station at Timsbury in 1876. This was followed by their second station at Twyford, started in 1898. Southampton chose a site at Otterbourne after a comprehensive survey by Mr. W. Whittaker of about 90 wells in the surrounding area. This showed a water gradient of about 12.5 ft mile^{-1} (0.2%) towards the site for the surrounding two miles. The site was alongside the London & South Western Railway, for coal supplies, and high enough above the town at 247 ft (75 m) above sea level, that reservoirs on Otterbourne hill could supply the town by gravity along a pipeline laid alongside the railway to Swaythling where is joined the Mansbridge system.

The wells were sunk to a depth of 120 ft (37 m) and were interconnected by adits 13 ft high by 4 ft wide (4.0 m x 1.2 m) which eventually reached a total length of 2800 yd (2.6 km). Matthews decided to drill the wells, providing a separate well for each pumping engine. At the time, 1885, large wells were dug and the 6 ft diameter wells at Otterbourne were the largest drilled wells in the country. Matthews estimated that the alternative single, brick lined, elliptical well, 19ft (6 m) by 9 ft (2.7 m), would have cost 40% more than the pair of drilled wells. The wells were sunk by the 'chisel and shell' method: the chalk was broken up by punching with three chisels and then the spoil removed by a 'miser' (Fig. 43). A portable steam engine winched the tools up and down and a gang of 12 men were employed to 'walk round' (i.e. rotate) the miser or chisel assembly when they had been lowered into the bore. Subsequently, the wells were lined with steel plate sections.

The first steam pumping engines at Otterbourne were commissioned in 1888 and, with the new supply established, the Mansbridge engines were taken out of service in 1892 and dismantled. The two initial wells were each pumped by a beam engine supplied by James Simpson & Co. Ltd. The beam engines, labelled **A** and **B**, were Woolf compounds with high pressure cylinders 28½ inches (0.72 m) diameter by 4 ft 9 in (1.45 m)

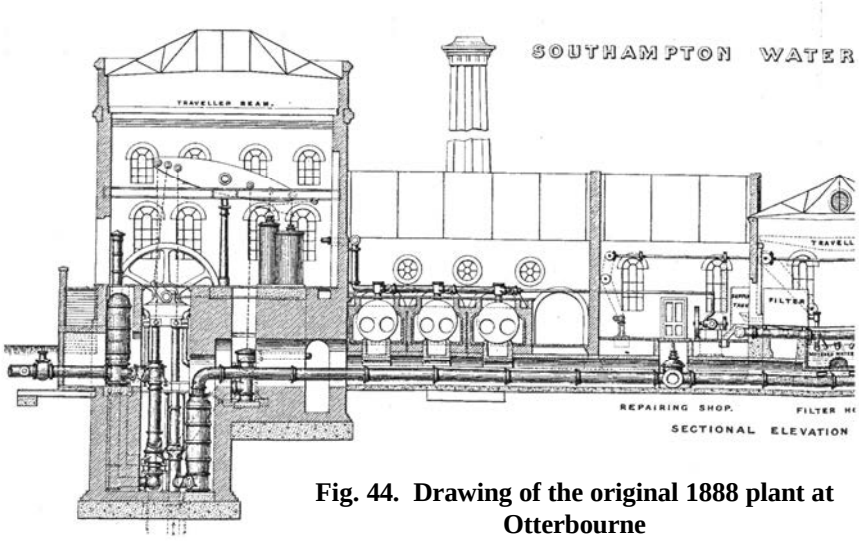


Fig. 44. Drawing of the original 1888 plant at Otterbourne

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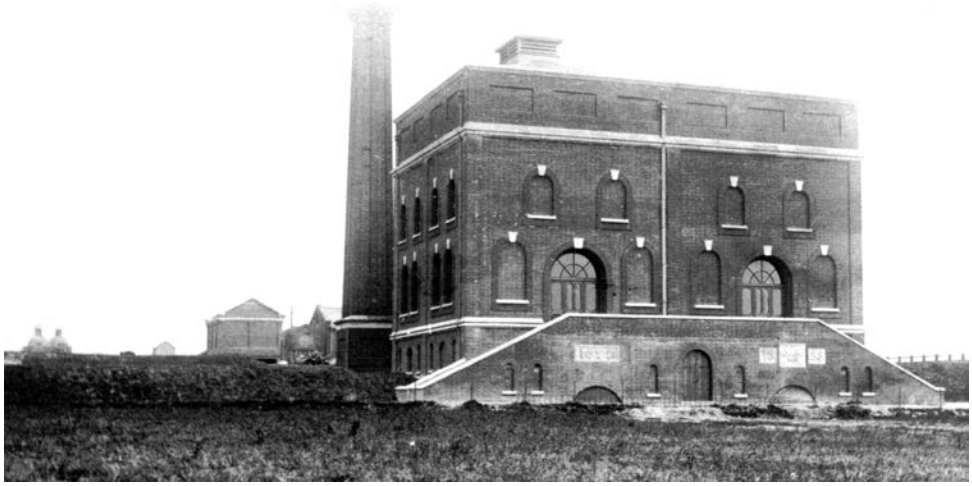


Fig. 45. Otterbourne c1900: A and B engines on the right, C and D on the left. Note the lime kilns on the far left and the softening plant behind the chimney.

stroke and low pressure cylinders 38½ inches (0.98 m) diameter by 7 ft (2.1 m) stroke. The beams were 23 ft (7.0 m) long and each engine drove two pumps from the crankshaft end of the beam; one pump to raise water from the well to the softening plant and the other to deliver softened water to the service reservoir. Each engine could pump 2 million galls (9 Ml) per day from the wells to the service reservoir. Otterbourne proved an excellent source so that in 1896 the size of the engine house was doubled and another Woolf compound beam engine, **C**, purchased from James Simpson & Co. Ltd. It was identical with the 1888 engines. To complete the plant, a fourth beam engine, **D**, was installed alongside engine **C** in 1902 to bring the capacity of the plant up to 8 million galls (36 Ml) per day. In 1900, the average daily supply was 3.5 million galls (16 Ml) per day.

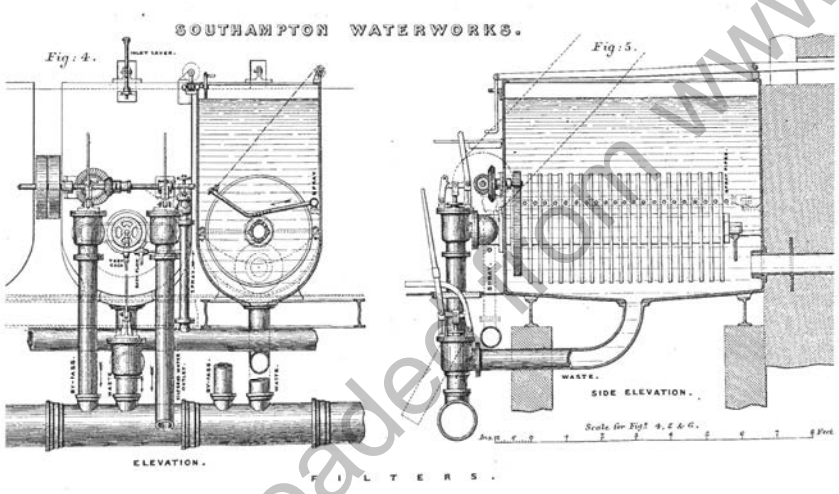


Fig. 46. Atkins' patent rotary filters for the Clark softening plant

Water softening plant was installed as part of the original scheme. This followed the Atkins modification of the Clark process. It was claimed to be the first Clark process plant to soften more than one million gallons (4.5 Ml) per day. Two flare pattern lime kilns and a lime mixing plant were built to provide calcium hydroxide solution (lime water) to soften the well water. In the original Clark process of 1841, as at Timsbury, the water moved slowly enough through the softening plant for all the precipitate to settle out, so that filters were not necessary. At Otterbourne, Matthews aimed at softening a much larger volume of water per day much more quickly. There was a single softening tank feeding an array of Atkins Patent rotary cloth filters. Patented in 1881, each filter tank in the Atkins' system contained 20 disc filters rotating on a hollow shaft. Softened water passed through the cloth into the inside of the wheel-like filter element and out along the hollow axle. Jets of high pressure water were used to remove precipitate from the filters as they rotated. However, perhaps there were maintenance problems with the seals and lubrication of the revolving filters

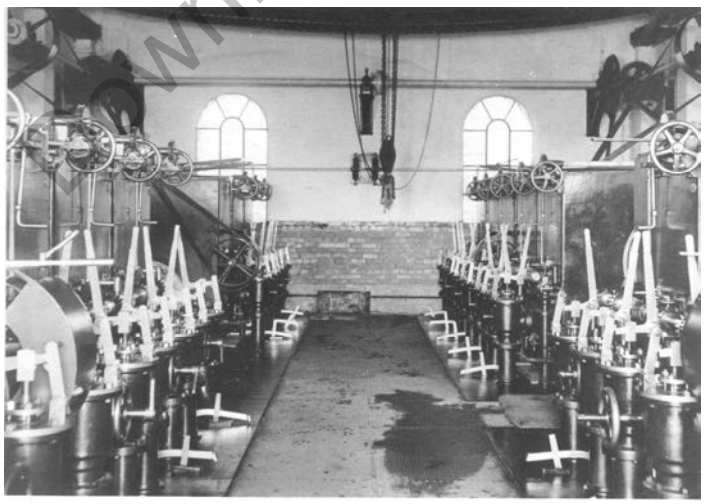


Fig. 47. The Atkins filter installation c1900

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in a clean water environment, for Mr. Haines, the resident engineer at Otterbourne, patented his own filter system which became standard on the Southampton Waterworks and other systems. The only remaining example of a Clark water softening plant, this time with Haines' filters, is at the Twyford Waterworks Museum nearby.

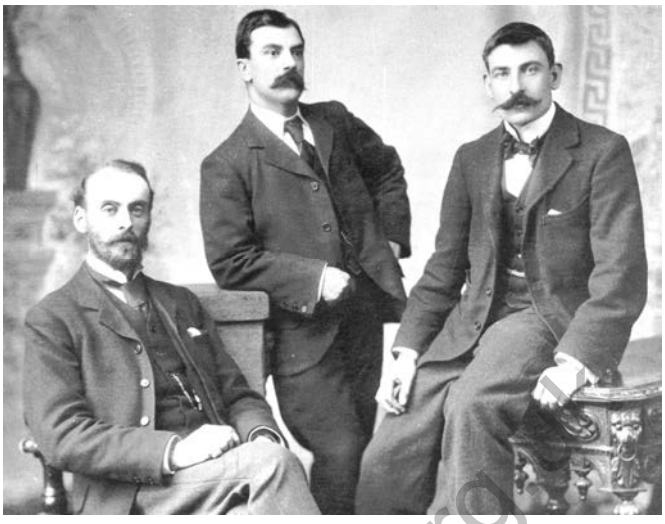


Fig. 48. Southampton Corporation Waterworks staff: L – R: W. Matthews (Corporation Water Engineer), C. Haines (Engineer at Otterbourne), E. T. Hildred (Site Construction Engineer)

After 1918 the population of the Solent area increased rapidly. Average daily supply had risen to 7 million galls (32 Ml) per day. Southampton Corporation had only one pumping station, Otterbourne, from which it supplied most of the Borough and Southampton Docks. This was now at full stretch. In 1921 the Corporation took over the South Hants Water Company with its pumping stations at Timsbury and Twyford. This provided it with two more sources of water and gave it control over the supply to most of the new expanding suburbs and areas around the Borough. During the 1920s and 1930s it improved the infrastructure by interconnecting the three sources and setting up a new 'high level' supply based on reservoirs at Yew Hill, Compton, supplied from Otterbourne and Twyford. To meet this increased demand, new and larger pumping plant was installed at all three sources.

The expansion at Otterbourne in the interwar years was all steam powered. The first stage, started in 1925 and finished in 1928, involved building a new engine house, abutting the old one, for two inverted vertical triple expansion steam engines, two new wells, extensions to the adits and extensions to the water softening plant. The two new steam engines were numbers 5039 and 5040 from Worthington-Simpson Ltd., of Newark (the successors to James Simpson & Co.). Each engine drove two sets of pumps; a set of bucket pumps in the new well, sunk between the two engines, to raise water to the softening plant and a set of plunger pumps to deliver softened water to the service reservoir. [The same arrangement can be seen with the preserved engine at Twyford Waterworks.] They were very efficient engines fitted with the company's patented drop valves. The high pressure cylinders were 18 in (0.46 m) diameter, intermediate pressure cylinders 31 in (0.79 m) diameter, and low pressure cylinders 54 in (1.38 m) diameter, all with a stroke of 4 ft (1.2 m). At 27 rpm each engine pumped 6 million galls (27 Ml) per day. A range of five new Lancashire boilers, pressed to 200 psi (1.4 MPa) and fitted with superheaters, was provided. The new engine house also contained two steam generating sets to provide lighting and electrical power for the site.



Fig. 49. James Simpson beam engine C of 1896.



Fig. 50. The boiler house in 1970.

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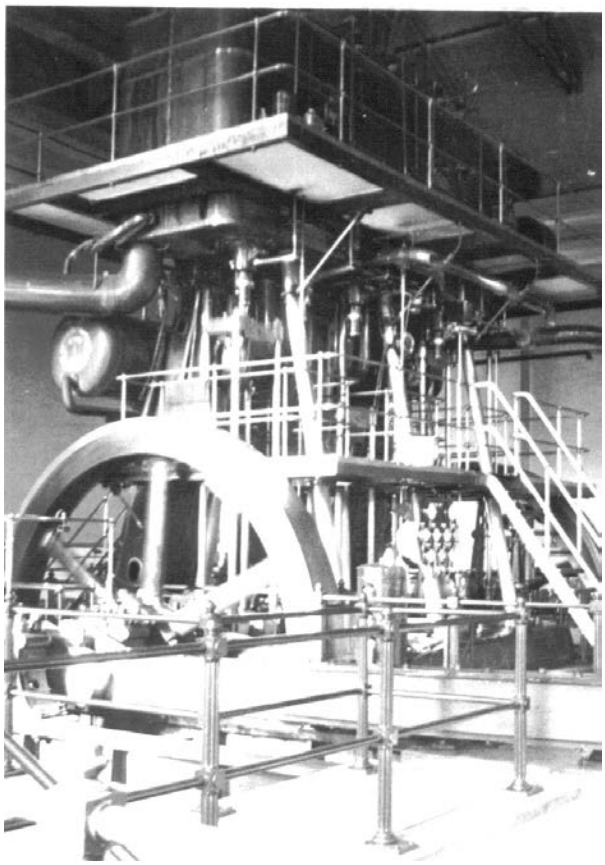


Fig. 51. Worthington-Simpson (west) inverted vertical triple expansion steam pumping engine (1928).
Note the crank and wooden pitman to drive the well pumps, in the foreground.

Probably the largest commercial customer of the waterworks was Southampton docks, for which the Corporation was the sole supplier in the twentieth century. In the days when ships were powered by steam and carried no de-salination equipment, the departure of a large liner created sudden demands on the water supply. The Cunard liners *Queen Mary* and *Queen Elisabeth*, for example, each took on 1.6 million galls (7.2 Ml) of fresh water for each voyage. This spike in demand had to be available at any time and at most berths. It was supplied from the Southampton Common reservoirs.

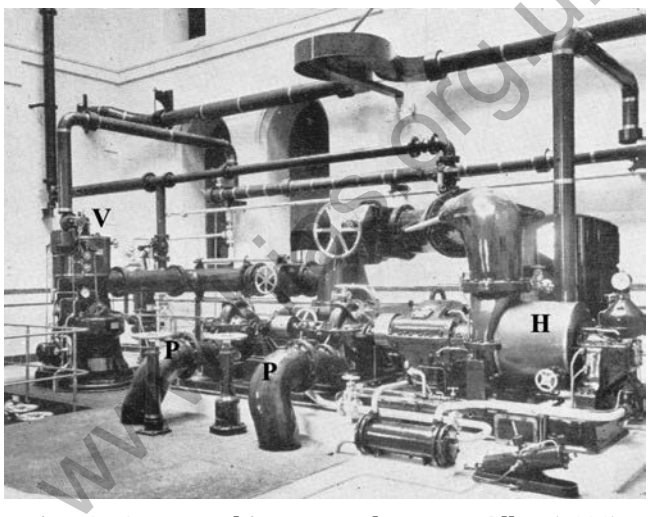


Fig. 52. Steam turbine pumps by W. H. Allen (1936).
(V) vertical axis well pump; (H) horizontal axis delivery pump (P) to reservoir.

By 1936 the beam engines were on standby and little used. The two 1888 engines, **A** and **B**, were scrapped and the house used to install two steam turbine driven centrifugal pumps by W. H. Allen, Sons & Co. Ltd. A vertical axis turbine drove, through a gear box, a vertical axis pump to raise water from the wells under the old beam engines, to the softening plant. A horizontal axis turbine drove, through a gear box, two pumps in series. The steam turbine plant raised the capacity by 4 million galls (18 Ml) per day and could pump water into the original Otterbourne (low level) system, the Twyford (intermediate level) system, or the new Yew Hill (high level) system.



Fig. 53. Intake from the river Itchen.

The demand for water continued to rise. In 1931, through the Southampton Corporation Act of that year, powers were obtained to abstract 10 million galls (45 Ml) per day from the river Itchen at Otterbourne. The expansion of the well pumping plant there meant that these powers were not needed immediately. By the outbreak of war in 1939 the average daily demand had risen to over 11 million galls (50 Ml) per day and an urgent start was made on the new river Itchen abstraction works. This involved building an intake on the river, a screening chamber and pump house, linked to the old site by a new bridge under the railway. The river water, unlike well water, required filtering and more chemical treatment in addition to softening. A new treatment plant for the river water was built to the west of the steam plant. All the pumps were driven by electric motors powered by diesel generators in an integral power house for the plant. The first phase, for 3.5 million galls (16 Ml) per day, was completed

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under wartime conditions in 1942 and proved a great asset in the run-up to D-day. Following D-day, in June 1944, over 107 million galls (480 Ml) of water was shipped in tankers to the troops in Normandy.

Completion of the river Itchen supply works had to wait until after the war. The second phase was started in 1950 and brought into use in May 1953. The final phase was started in 1958 and completed in 1960. With its completion came an electricity supply at 11 kV from the Grid. From 1960 the Grid electricity supply became more and more important, with the diesel generators used at peak times in the winter. By 1960, the average daily supply had risen to 18 million galls (81 Ml) per day, with a total installed capacity for Otterbourne, Twyford and Timsbury of 25 million galls (112 Ml) per day.

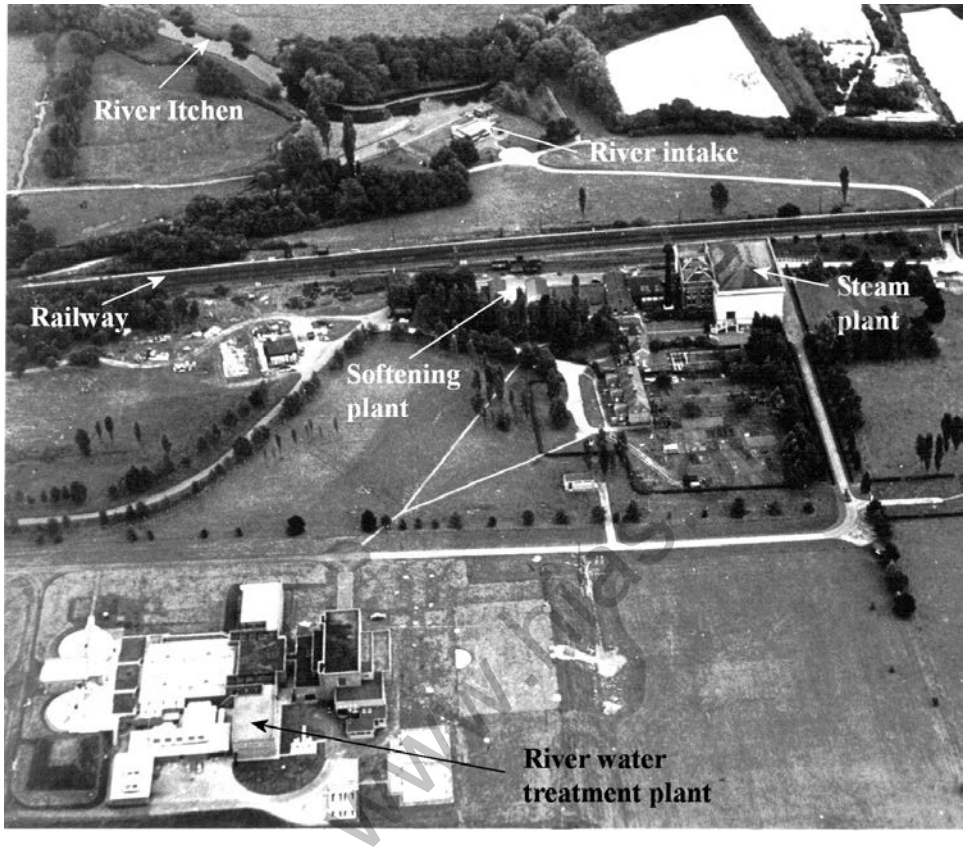


Fig. 54. Aerial view of the site c1960

During the 1960s water softening became both uneconomic and unnecessary. Modern detergents could produce a lather in hard water and, medically, hard water was better for your cardio-vascular system. By 1970, the youngest reciprocating steam engines were 45 years old and the steam turbines 35. Water softening ceased and thereby created a further problem in that the softening plant was an integral part of the water circuit of the steam powered station. In July 1971 the steam engines were stopped for the last time and in 1972 the plant was demolished. One of the Simpson beam engines was dismantled for possible preservation but this has not yet come to pass. After 35 years of storage in the open, the rusty remains of most of the large parts are today for sale to anyone with deep enough pockets and sufficient enthusiasm to rebuild a once proud engine.

The wells remain in use with electric pumps, as does the river intake and its associated water treatment plant. On the old site, it is now difficult to make out where the different sections were located.



Fig. 55. The beam of engine C or D today.

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The Emsworth Gas and Coke Company

John Horne & Jane Yoward

The Emsworth Gas & Coke Company was founded in 1853 by the Provincial & Continental Gas Consumers' Company of Mark Lane, London, a company which also introduced gas to several other towns. The Emsworth concern was launched with a capital of £2000 in £10 shares and a site was purchased off North Street. The land was a rectangle measuring about 95 ft by 122 ft with no frontage to any road, access from North Street being through a narrow cartway. The town was first lighted by gas on 24th November 1853.

On the 23rd October 1852, the *Hampshire* Telegraph opined:

> It is in agitation to promote the welfare of the town of Emsworth, by substituting gas light for the miserable lamps which now feebly glimmer out a portion of a dark winters evening. There are few towns where there is so much freedom from nuisances as Emsworth, and the inhabitants are very considerably indebted to the active and prudential exertions of Mr D Stephens, the Vice President of the Board of Guardians, who is not only thoroughly acquainted, with the duties of his office, but works them out with an independence and good sense. We hope shortly, to announce the adoption of Gas-light, that the full benefit may be had before the winter is too far advanced.

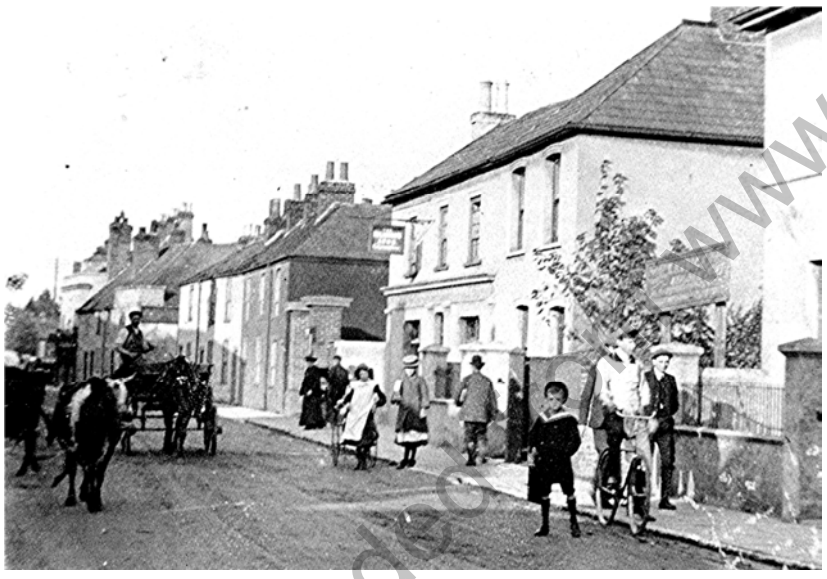


Fig. 56. North St. Emsworth, c1900. The entrance to the gasworks is between the two brick pillars in the centre of the photograph.

The first public meeting was held on the 15th November 1852 and was very well attended. Those parts of the Lighting and Watching Parishes Act which concerned lighting were adopted and the Inspectors empowered to raise rates for street lamps. The shareholders also held a meeting, on 19th November. Officers were elected at both these meetings. Each individual was limited to a maximum holding of ten shares. By May 1853, some dozen or so of the original shareholders had sold their shares, showing that confidence in the company was, perhaps, not as strong as it had been at first. The control of the Emsworth concern had passed into local hands by the end of 1853.

In September 1853, The *Hampshire Telegraph* reported that the laying of pipes throughout the town had been finished and that the gas holder was nearing completion. This must have caused some disruption - similar to that experienced a few years ago when the cable companies laid their television cables along all the town's streets. The Directors requested applications from those who wished to be connected to the gas supply. The company would pay for the branch pipes from the mains, but customers would have to rent or purchase meters. However, the price of the gas was not stated. It was to be 9/- per 1000 cubic feet (l/- less than neighbouring Havant). Also, a dispute had arisen regarding the Emsworth Lighting Rate requested by the Inspectors for erecting lampposts - £150 - which delayed the start of the use of gas in Emsworth. Mr D.W. Stephens disputed his payment and was summonsed to appear before the Havant Bench. The rate was proved "bad' since it did not comply with the Act, and the summons was dismissed. The magistrates added that they had seldom seen more irregularities. The *Hampshire Telegraph* suggested in October that there were no legally appointed inspectors and asked why so few attended meetings. In November, the courts judged that the inspectors had, indeed, been elected illegally. On the 26th November 1853 the *Hampshire Telegraph* reported:

> On Thursday (24th November) the shops in the town of Emsworth were lighted with gas for the first time; the weather was extremely unpropitious and the sight was thus lost to many of the inhabitants, who would have otherwise have witnessed the improvements. The Directors charge at present 9/- per 1,000 cubic feet, being

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one shilling lower than the neighbouring town of Havant. The non settlement of the Gas question, however, continues an obstacle to the lighting of the roads and streets, and which after all, is the most important matter; for as the shops generally are closed soon after eight p.m., the most profound darkness then reigns around. We hope shortly to be able to report a return to the degree of common sense and honesty which shall dissipate all future difficulties, and disappoint the efforts of a few who delight in discord to satisfy the most selfish motives, and who are seeking by every possible means, to rule the majority by a very small minority of ratepayers. By unity, all that is desired can be easily accomplished; by disunion it never can; the longer the question is held in abeyance, the more irreconcilable parties become. We therefore appeal earnestly to the present "quondam" Inspectors, to take a decisive course in restoring peace and confidence amongst their neighbours without further delay, or they may rest assured that the Gas question in Emsworth will never prosper, as they wish.

Around the town, lamplighters would have been employed, probably by the parish or council, to light the street lamps at dusk. Previously, the street lamps would have burned oil, with the lamplighters employed to trim and light them. Both oil and gas lamplighters had to carry ladders around to reach the lights.



Fig. 57. A shop with external gas lamps illuminating the shop window. A century later this became the Yoward Pharmacy!

Emsworth was one of many early gas companies which chose not to operate the business themselves, but to lease it to somebody for a fixed annual payment. In 1876, the year in which the Company was registered with limited liability, the lessee was J. Douglas, well known in connection with the Portsea Company. The Emsworth Gas & Coke Company continued in the usual way with a Chairman, Secretary (James Stenning) and Board, paying dividends and meeting occasionally, but their income was confined to the regular rental payments from Mr Douglas. It was Douglas who bought the coal, made the gas and traded with the customers.

When a lease was up, the Company would seek competitive tenders for renewal and, by 1884, J.H. Lyon of Cosham had replaced Douglas as lessee. Such leases were difficult to manage when repairs and extensions were necessary and they became less common when the gas industry expanded more rapidly towards the end of the century. In 1889, Emsworth again invited offers from those who would take over the running of the works for them, but it seems that they decided to resume direct control and a Mr S.B. Darwin was appointed Manager. The Chairman was A.G. Tatchell by that date.

The Company obtained a Special Order in the 1884 Parliamentary session “to confirm certain Provisional Orders made by the Board of Trade under the Gas and Water Works Facilities Act 1870, relating to Emsworth Gas and Coke Company”. This became known as the Emsworth Gas Order 1884. permitting them to supply gas in Warblington and over the Hampshire/Sussex boundary into Westbourne. A very substantial increase in share capital was also granted, from £2600 to £12 600, with powers to borrow £3150, although little of this capital was ever issued. It also allowed the Company to maintain and continue the gasworks, to make gas and manufacture coal tar, pitch, asphaltum and ammoniacal liquor, oil and all other residual products. They were to supply and manufacture gas at a price of 5/- per 1000 cubic feet for 14 candle-power gas and to purchase or hire and supply gas meters, fittings, gas stoves and cooking and other apparatus. Dividends were linked to the gas price by a sliding scale which permitted high dividends only when the customers received cheap gas. Some objections were lodged against the Order, but the Board of

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Trade did not think it necessary to hold an enquiry. For some reason, the Company changed its book keeping so that the financial year would end on 29th September, rather than 31st December as prescribed by Gasworks Clauses Act of 1871.

Those who worked in small gasworks had to be versatile, a fact confirmed by an advertisement placed by the Emsworth Company in September 1893:

> WANTED, a handy mechanic as WORKING FOREMAN for a small gas-works on the south coast; one used to forge work, main and service laying, and meter reading. House with good garden, gas and coal.
> Apply with testimonials, stating age, wages required and present occupation to J.W. Loader Cooper Esq., Solicitor and Secretary, Queen Street, EMSWORTH.

James William Loader Cooper was still acting as the Company's Secretary in 1914. A period of steady growth began in the 1890s, assisted by a reduction in the price of gas from 5/- to 4/9d per 1000 cubic feet in 1899. By 1913 it was down to 4/1d and the shareholders were receiving a steady 10% on the ordinary shares.

The Annual Meeting held in December 1908 was stormy, as the report revealed poor working results, summarised as (1 million cubic feet = 28 400 m^3):

1907 - 772 tons carbonised, 7.1 million cubic feet made, 6.7 millions sold.
1908 - 904 tons carbonised, 7.6 million cubic feet made, 6.9 millions sold.



Fig. 58. Emsworth Square, c1900, showing a gas lamp and the village pump.

Working profits were much reduced but, by drawing on reserves, a full dividend was paid, rather than the reduced payment which the Directors had recommended. The Chairman, still A.G. Tatchell, succeeded in being re-elected but it was clear that the Company needed guidance and T.E. Pye, the Engineer and Manager of the much larger Chichester Gas Company, was voted onto the Board. The alternative would have been to hire a Consulting Engineer, but recruiting a competent local man was better. It would be interesting to learn how many Emsworth shares Pye had to purchase in order to qualify as a Director and whether he harboured any thoughts of Chichester absorbing the Emsworth concern. His Board at Chichester may have thought so, for their permission would have been necessary before he could take up this 'outside' post.

Year	Output/ Million cu. ft.	Number of customers	Number of public lamps	Length of mains/miles
1894	2.5			
1899	3.5	105	54	
1904/5	7.1	128	62	3.75
1909/10	7.1	190		5.0
1913	11.5	367	104	

The growth of the Emsworth Gas & Coke Company Limited 1909 - 1913

The following June, a new Manager was appointed, William Walton, who had been 15 years with the Portsea Island Gas Light Company, and who was able to improve the performance of the Company both in the works and on the district. There were twice as many customers when he left late in 1915 to become Manager of the

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Bradford-on-Avon gasworks. When advertising for Walton's successor, the Company stipulated that he must be "experienced in regenerative settings"; perhaps it was these modern retort settings which had enabled Emsworth's production results to be so greatly improved. The job was offered at £100 per annum, plus free house, coals and gas.

During the twenty years from 1891 to 1911, the population of Warblington (including Emsworth) had increased from 2840 to 3771. The Company's return to “Gas Works Directory & Statistics” in December 1913 revealed that the paid up share capital was still only £4600, although loans totalled £2650 at 4½%. In later years; in both May 1908 and July 1913, 100 £10 shares were offered for sale by auction, in lots of 2 shares, to raise the additional capital. In 1913, 1179 tons of coal were carbonised to make 11 514 300 cubic feet of gas. Sales were 9 507 200 cubic feet. There were 66 stoves on the district but, surprisingly, there was no mention of slot meters.

As the Company's records do not appear to survive, the difficulties which doubtless accompanied the Great War cannot be recounted here. Most companies found the first years of peace just as challenging. Emsworth was growing again so, in 1924, the Company obtained a further Special Order, extending the gasworks by 3310 square yards on the south side and adding Racton and Stoughton to the supply area. The new land had been purchased in 1922, and now extended as far as the newly constructed Palmers Road. A new two lift gasholder of about 95 000 cubic feet capacity was built in 1924 but a more significant development was the water-gas plant which started working in December 1922, in time for the Christmas peak demand.

The retort house contained two beds of retorts, one of eight and the other of six retorts. When the demand for gas again began to grow after the war, it became necessary for the exhauster to ‘pull’ too much. This increased the volume of gas made but the proportion of inert constituents rose, spoiling the heating value. To have built more retorts would have strained the Company's resources (prices were high then) so their Consulting Engineer, T.N.Ritson of Chichester gas works, advised a water-gas plant.

Water-gas was made by passing steam through a bed of incandescent coke and was mostly carbon monoxide and hydrogen. The coke was cooled by this process but its temperature was restored by blowing air through it; a boiler and a small high-speed Robey fan engine were installed. Water-gas had been common in medium and large-sized gas works for many years but Emsworth was probably the smallest works in England to make it. British Furnaces Ltd. had built such plants for abroad but this was their first for town gas supply in the UK.

Water-gas had a lower calorific value (CV) than coal gas, with which it was usually mixed, but a carburettor could increase that value by cracking gas oil. At Emsworth, there was no external carburettor but it was found possible to add about one gallon of gas oil to the generator for each 1000 cubic feet of gas made, raising the CV from 300 for 'blue' water gas to 400 B.Th.U. per cubic foot. This cost no more than the coal gas with which it was blended to make a town gas of 470 CV. The plant was much cheaper to build and operate than extra retorts would have been. “A youth with no previous experience has to date run the plant, under the supervision of the Engineer, Mr. Jones”!

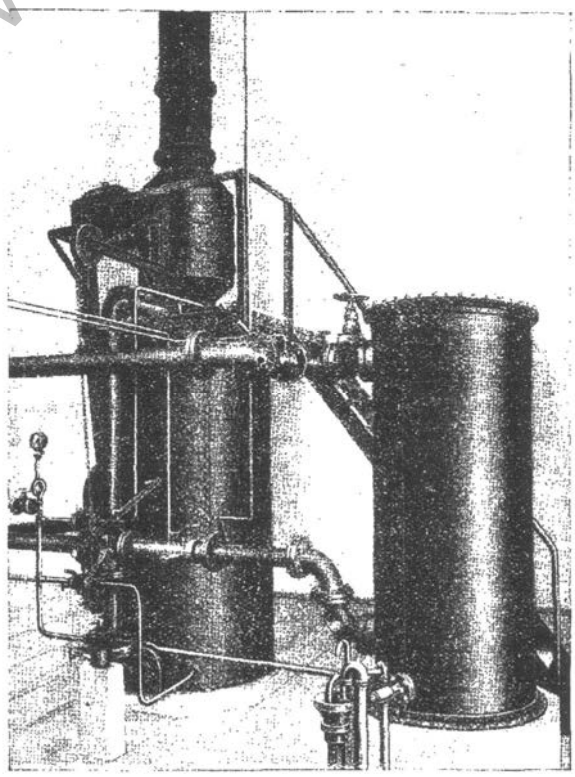


Fig. 59. Water-gas plant by British Furnaces Ltd. for Emsworth gasworks.

Customers noted an improvement in gas quality, with fewer variations. The new plant ran only intermittently in summer, but made a bigger contribution in winter. It consumed some of the coke which would otherwise have been offered for sale, although Mr. Jones probably regarded it an advantage to be able to control his coke stocks to some extent.

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Portsea Island Gas Company was founded in May 1821 using an established gasworks near the dockyard. New gasworks were opened at Flathouse in 1834 and at Hilsea in 1904. By the 1920s it already had a toehold on the mainland and eventually sold gas to almost all of south-east Hampshire with Emsworth as their most easterly outpost. The company's name changed to Portsmouth Gas Company in July 1926. In January 1924, Portsmouth Gas Company wrote to Emsworth Gas and Coke Company offering to supply gas in bulk or to open negotiations for the acquisition of their undertaking, conditional upon the purchase of Havant Gas Company. The Directors of both Havant and Emsworth's gas companies enquired about conditions and terms of purchase were drawn up. In December, Havant agreed to the terms and they were officially taken over on 1st July 1926 with the Havant gasworks closing in August.

In June 1926, the Emsworth Company requested that negotiations recommence and an offer was made. The terms were agreed and sealed on the 26th August 1926 and the Parliamentary Agents instructed to proceed with the draft application to the Board of Trade. An Extraordinary General Meeting of Portsmouth Gas Company was held in October 1926 to authorise the acquisition of the Emsworth Gas and Coke Company Limited and the creation and issue of additional ordinary and loan capital under the powers of the Portsmouth Gas Order 1926. A Special Order was made in July 1927 and Portsmouth Gas Company's acquisition of the Emsworth Gas and Coke Company would take effect from 30th September 1927. Letters were then circulated to Emsworth residents and shareholders of the Emsworth Gas and Coke Company regarding the acquisition. In accordance with the Portsmouth Gas Order 1927, shares in the Emsworth Gas and Coke Company were transferred to ones in the Portsmouth Gas Company - a total of £4714 5% Maximum Stock and £9916 Consolidated Stock being issued.

The gasworks adjoining North Street passed into the ownership of the Portsmouth Gas Company and was closed on 26th November. Whether the pioneering Water-gas Plant found a new home is not known, but it deserved to. The two existing gas holders at the Emsworth gasworks site were sold for £130 to Messrs Firth, Blakely, Sons & Co, who would dismantle them.

At the time of the take-over, the Manager of the Emsworth Gas and Coke Company was Benjamin Fulford Jones and the Secretary and Collector was still James William Loader Cooper. The employees of the Emsworth Company became employees of the Portsmouth Gas Company and were immediately admitted to the company's pension scheme.



Fig. 60. Hydraulic piledriver at work in 1933 on the foundations for the new gas holder. In the left background can be seen the houses in Palmers Road.

An extension of the mains from Portsmouth to Havant and Emsworth was required to coincide with the take-over. A quotation for 3750 yards of 12 inch (305 mm) spun iron pipes at £3/6/10d per 12 ft (3.7 m) length and a tender for pipe laying at 9/6d per yard with an additional 9d per yard where pumping was required, were accepted. The laying of these mains had to be agreed with the Highways Authorities and a different route was requested to avoid disturbance and subsequent reinstatement of the main road. The engineer's report stated that re-routing would prove prohibitively expensive and the mains were laid along the main road as originally planned, with little inconvenience. An average of 45 men were employed on laying the mains from 29th August to 25th November 1927. The new gas supply from Portsmouth was switched on during the morning of 26th November 1927. At the same time the Emsworth gasworks was closed down as a manufacturing plant. Gas consumption continued to grow and, by 1957, the Emsworth district served 1050 credit and 1893 prepayment (slot-meter) customers. There was still a small showroom in the town but it opened only three days per week and was closed permanently soon after.

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The new owners made good use of the extra land by building a large gas holder there in 1934. The new holder was manufactured by Messrs Robert Dempster in 1933. The plates were cut to size, the gas holder was then constructed in sections at the factory and each plate was numbered to show its final position. It was then dismantled and the plates were transported by rail to Emsworth station where they were then carted to the site by Lashleys. The gas holder was built on piles which were sunk using an hydraulic piledriver. The steel piles were then filled with cement and the steel tube was withdrawn leaving the concrete pile in position. The concrete base was completed in July and the first side sheets erected by September 1933.

The steel tank was, and is, 150 feet (46 m) in diameter by 33 feet (10 m) deep and built above-ground. There were two spirally-guided lifts at first but a third was added in 1946 to give a capacity of 1.52 million cubic feet (43 000 m^3). It was far larger than Emsworth itself required but compressors were installed so that gas could be returned to the medium pressure system at peak load. The holder was commissioned with some ceremony on 31st July 1934 by Councillor John Lewis who in 1927 had also led the official closing of production at Emsworth gas works.

Today, only the gas holder, which is visible from almost every part of Emsworth and beyond, remains. In recent years, there have been moves to have the gas holder dismantled. When a survey was held in 1977, 72% regarded the gas holder as unsightly whilst a few thought it a positive asset as a landmark, from the harbour. However, The Southern Gas Board did not wish to initiate its removal and it is still in use today.

Two new compressors were installed in 1957 so that gas from Emsworth could be sent forward to Chichester at 15 psi, enabling that works to be



Fig. 61.The concrete foundations for the new gas holder are complete by July 1933.

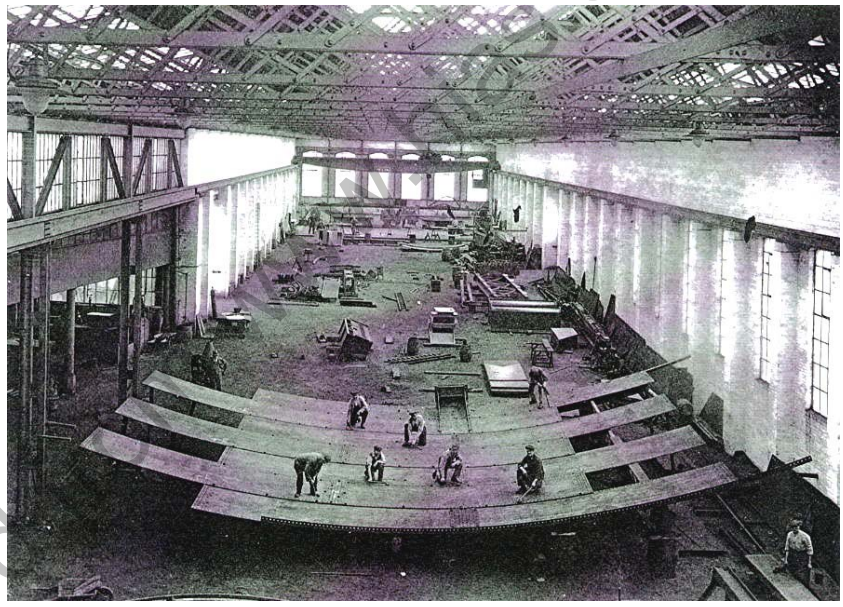


Fig. 62. Steel plates being drilled and pre-assembled for the gas holder, in Dempster's factory.



Fig. 63. Assembling the gas holder on the Emsworth site.

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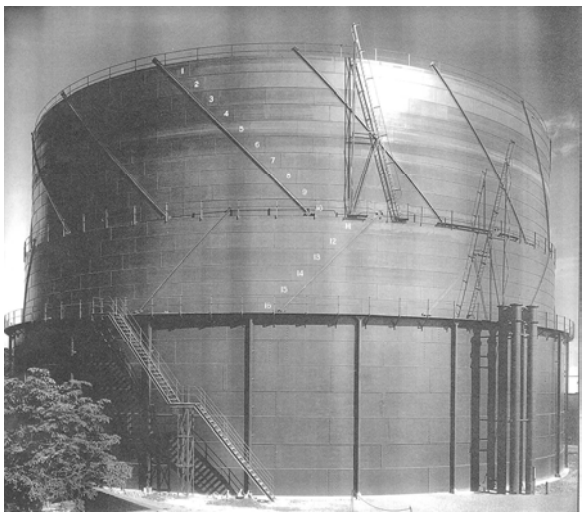


Fig. 64. The completed gas holder in 1934.

closed also. There were two machines, each of 150 000 cubic feet per hour capacity, one diesel driven and one electric. The existing buildings were extended for them by the local firm of H. Richardson.

In time, automation displaced the three shifts of men who operated the Emsworth compressors. In the late 1950s a 'supergrid' system of steel pipelines reached Chichester so that recompression at Emsworth was no longer vital. A new holder station at Chichester comprised entirely high-pressure vessels and the traditional gasholders were cleared away; this has not yet happened at Emsworth where operating costs are low. Emsworth gas holder, while no longer an essential part of local gas supply, remains useful and can help (in a small way) to reduce operating costs by 'peak-shaving' the heaviest demands on the pipeline network. At the time of writing it is fully operational and is likely to remain so until heavy repairs are necessary.

A note on gas prices (all quoted per 1000 cubic feet (28 m^3) of gas.)

London's gas price was 16/- at the beginning of the nineteenth century. This had reduced to 4/- by the 1830s and to 2/6d by the end of the nineteenth century, though this still accounted for a large proportion of many household bills.

As the key energy source, the price of coal per ton in 1861 was quoted by one *Hampshire Telegraph* correspondent as: Brighton 33/-, Bristol and Hull 18/-. An editorial in the *Hampshire Telegraph* of February 1865, questioned the 'very high price' of gas. It queried the fact that some areas of London could insist that their price was 2/9d. There seems to have been a constant complaint about the fluctuations in customers' bills and the editorial also stated that if the local gas complied with the Government standards for illumination, then those standards were too low.

	Portsea Island	Gosport	Farcham	Havant
Receipts	£99,392	£13,448	£3,882	£1,797
Expenditure	£74,700	£9,015	£2,517	£1,246
Profits	£24,692	£4,433	£765	£551
Coals Used (tons)	62,770	7,296	1,422	797
Gas Made (cu ft)	649,911,000	71,619,000	13,500,000	7,974,000
Mains (miles)	150	22	7	6
Consumers	10,400	900	350	197
Public Lamps	2,079	336	?	55
Price	2/4	4/2	3/9	3/9

Table 1. Parliamentary for Hampshire gas companies in 1894. Unfortunately, Emsworth is not included.

The price of gas varied between companies since the overheads differed (Table 1). Those with large areas of supply could spread the overheads among a large number of consumers, thus bringing down the cost of the gas to individual consumers. Emsworth gas was charged for at 6/8d in 1883 and many were unable to afford it. Since Emsworth had access to coal by sea and rail the query arose as to how the company could justify this price. Emsworth still has a public house called 'The Coal Exchange' which was actually used as a market place for the sale of the coal that came ashore from colliers beached 100 yards away.

By 1884, the price of gas in Portsmouth was 2/9d, that at Cosham 3/8d and at Havant it was 4/7d. Emsworth gas was still at the high price of 6/8d. The price of gas in Emsworth was 8/4d by March 1922, even though neighbouring Havant was selling it at 6/6d. From 1st October 1927, the day after the takeover, the price of gas was reduced by 2d a therm (equivalent to 9d per 1000 cubic feet). Two further reductions were to be made over the following five years.

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A note on gas meters

Gas meters were developed about 1816, but were slow to become common-place. Until the 1850s, gas was often charged for by the number of burners in a consumer's premises. Gas meters then became more common, though the readings they gave of the volume of gas used were often unreliable. In February 1859, Thomas Glover applied to the Portsea Gas Company to allow consumers to use his dry gas meters. They had been used in London and other cities including Chichester. It was found that the meters had indeed been used in the Portsmouth area for some time and they were soon adopted. Until this time, 'wet' meters had been in use and consumers complained that they caused lights to 'jump' and go out. They had been known to register up to 35% higher than the amount of gas actually consumed - some in Manchester had been found to read 60% over!

The gas meters were rented from the company; for example, the Basingstoke Gas and Coke Company charging 1/6d a quarter for meter rental in both 1851 and 1869 (Hampshire Record Office 8M62/110).

The Sale of Gas Act 1859 called for Meter Inspectors, paid for by the county rate or the borough's lighting funds. These inspectors were prohibited from repairing, making and selling gas meters or from holding any appointment within any kind of gas company. They were legally allowed to enter any metered premises, at a reasonable time, to examine and test the consumer's meter. The Inspector's own meters had to be tested. They were only allowed to vary between 2% in favour of the seller and 3% in favour of the consumer. Since gas was principally used for lighting, its illuminating power was also regularly checked to ensure that it met the standards laid down.

Tailpiece

At about 10 pm on Thursday 13th May 1993, a Group 4 security van doing a routine check in Palmers Road discovered two suspicious looking packages close to the Emsworth gas holder. Police were called and fifty households (about one hundred and sixty people) were evacuated and the area sealed off by the police. Residents were accommodated in St James Church Hall. Bomb disposal experts examined the parcels and found them to be hoax objects. It was not until after 04:30 next morning that the residents were allowed to return to their homes.



Fig. 65. An aerial view of Emsworth showing the 1934 gas holder which still dominates the town.

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Further reading:

Gas Journal, Water-gas Plants for Small Gas-works. New Plant at Emsworth, p 934, September 26, 1923
Portsmouth Gas Company, Inauguration of Gas Holder and Governor Plant at Emsworth, Tuesday 31st July, 1934

Publications

Published by Southampton University Industrial Archaeology Group

Adrian Rance (ed) *Seaplanes and Flying Boats of the Solent*
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Monica Ellis *Ice and Icehouses Through the Ages* (with Hampshire gazetteer)
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No. 1 (1992); *No. 2* (1993); *No. 3* (1994); *No. 4* (1995); *No. 5* (1996); *No. 6* (1997); *No.7* (1998); *No. 8* (1999); *No. 9* (2000/2001)
£5.00 each to non-members

Published by Hampshire Industrial Archaeology Society

Martin Gregory (ed) *Hampshire Industrial Archaeology Society Journal*
No.10 (2002); *No. 11* (2003); *No. 12* (2004); *No 13* (2005); *No 14* (2006); *No. 15* (2007*); No. 16* (2008); *No. 17* (2009)
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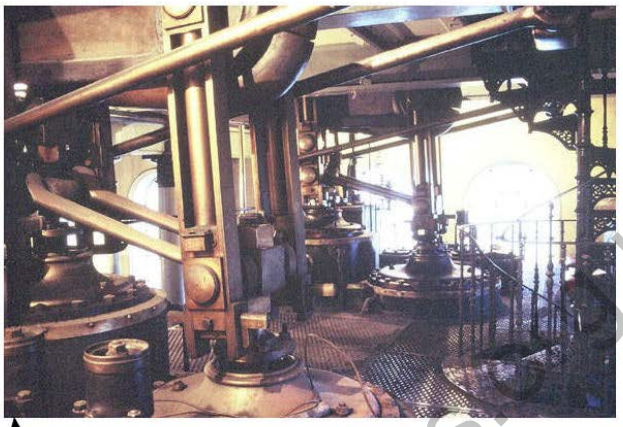
Hampshire Industrial Archaeology Society

Hampshire Industrial Archaeology Society was founded as the Southampton University Industrial Archaeology Group in the 1960s from members of the University Extra-Mural classes who wished to continue their studies in industrial archaeology. Recording has included surveys of mills, breweries, brickworks, roads and farm buildings. Restoration is undertaken directly or by associated groups such as Tram 57 Project, the Hampshire Mills Group and the Twyford Waterworks Trust. In addition to the Journal, the Society publishes a newsletter (Focus) twice a year and lecture meetings are held every month.

To join, contact the Membership Secretary:
Keith Andrews, 13 Ashley Close, Harestock, Winchester, Hampshire, SO22 6LR.

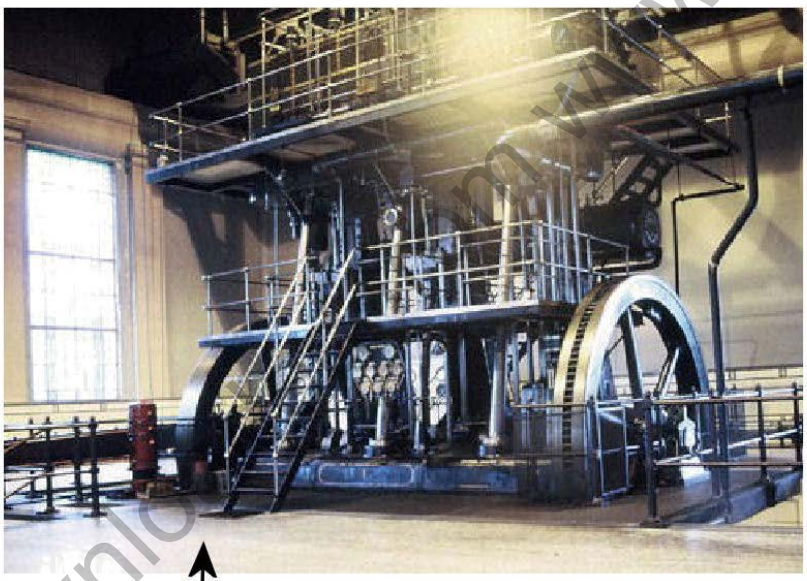
Southampton Corporation Waterworks, Otterbourne, c1970





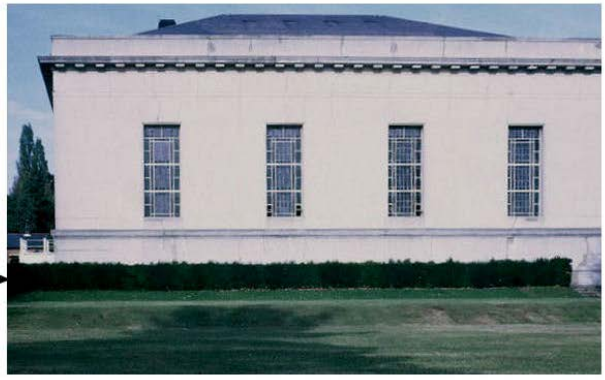
Parallel motion of beam engines C & D

1895 engine house for beam engines C & D



1928 Worthington-Simpson triple expansion pumping engine

Engine house for triple expansion engines.



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