SESSION 1912–1913

PRIZE ESSAY—GRADUATE SECTION.

The Thrust-block.

THE thrust-block became a feature of marine engineering on the introduction of the screw propeller. The thrust of the propeller (or force exerted by it upon the water) tended to produce longitudinal movement of the shafting, thus pressing the crank-shaft against its journals in the direction of motion. As the consequent forcing out of line of rods and gear would have resulted in great friction and serious damage, it was found necessary to place between the engine and propeller some means of taking up the thrust and relieving the crank-shaft of this extra load. For this purpose the section of shafting immediately aft of the engine was forged so as to admit of having several collars or rings turned on it as shown in the sketch. This part of the shaft was dove-tailed into a series of similar rings inside, and constituting an integral part of it, fitted into an iron box, made in halves to admit of the introduction of the shaft. Thus, when the engine was working and thrust was applied to the shafting, the faces of the collars on the shaft bore against the faces of the rings in the casting, transmitting the thrust to the box, and, as the latter was securely bolted down to the ship's frame, to the ship and relieving the crank-shaft of any longitudinal pressure. This was the earliest form of thrust-block.

Engineering science has advanced considerably since then, but the general form of the thrust-block has altered very little. The modern thrust-block is made in several forms, but the differences are merely those of detail, and the general principles underlying its design hold good for all cases. They may be enunciated as follows :—

A. It must be as rigid as possible and, hence, of strong and heavy design.

B. It must have ample bearing surface to take the great pressures which it transmits.

C. It must possess efficient means of cooling the working surfaces.

D. The working surfaces must be supplied with efficient means of lubrication, and, in addition to being efficient, the latter must be simple in form and not liable to get out of order.

E. The whole thrust must be of such a form that any of its parts can be conveniently and thoroughly examined.

F. Finally, the thrust-block must be very strongly and rigidly secured to the framing of the ship.

These desiderata are embodied in the type shown in the sketches. The body of the thrust is made of good cast iron and is well strengthened with ribs and webs. As can be seen from the sketch, the casting forms a box round the bottom halves of the bearing surfaces. When the engine is working, this box is kept full of water, a teak gland being fitted round the bottom half of the shaft at each end of the box. Hand holes with covers are provided as shown at each side of the thrust-block. Pillow-blocks, lined top and bottom with white metal, are fitted at each end to support the weight of the shaft. Usually these blocks are separate castings and, as shown, are bolted down to facings planed for that purpose. In cheaper work the bottom halves of the blocks form part of the main casting. One advantage of this form is that both blocks can be bored out at the same time, and thus are truly in line. The blocks are lubricated in the ordinary way by means of oil-boxes on the top halves, and usually a connexion is provided to the bottom halves from the tunnel water service.

Sketches 3 and 4 show the two commonest forms of thrust-shoe. The essential difference between the two lies in the method of adjustment for wear. In the type shown in 3 the shoe fits at each side over a heavy screwed bar of gun-metal running the whole length of the thrust and through bosses or brackets cast for the purpose at each end of the latter. They can be placed in these brackets or removed by lifting the covers shown in 1 and 2. The screws are provided with a nut at each end of the bosses, and these nuts, when tightened up, hold them firmly in position. As shown in 1, the bars are fitted with a nut at each side of each shoe, and the wear of the white-metal faces of the latter is taken up by slackening

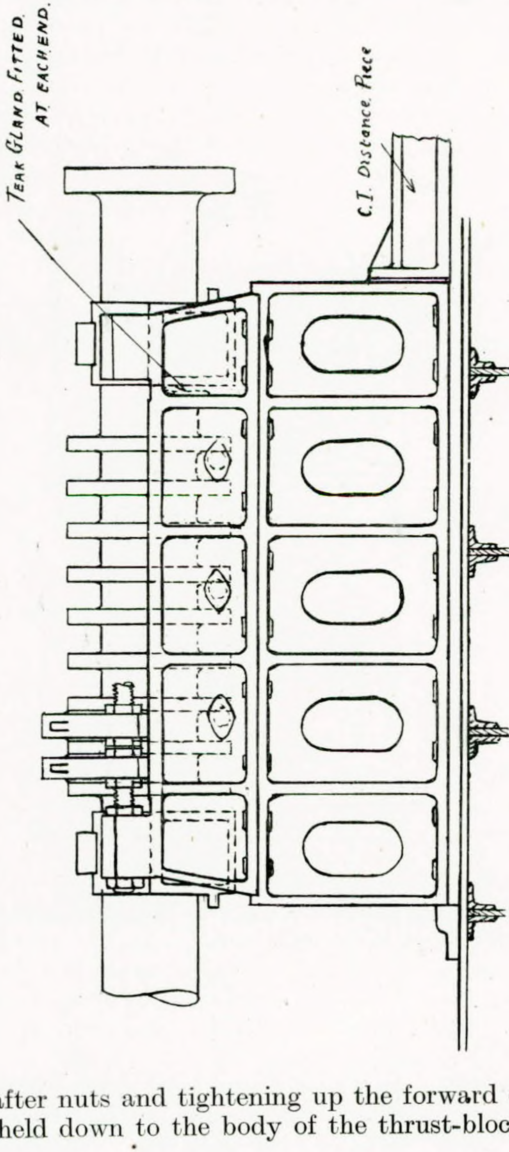

Fig. 1.

back the after nuts and tightening up the forward ones. The shoes are held down to the body of the thrust-block by studs passing through holes in the flanges of the latter as shown. These holes are made in the form of slots to allow for a small longitudinal travel of the shoe. This is a simple and efficient means of adjustment and finds much favour in modern practice.

The other method of adjustment is shown in sketch 4. This type of shoe has a solid block at each side. The sides of these blocks are machined and, when the shoes are in position, fit closely together as shown in 3, the space between them

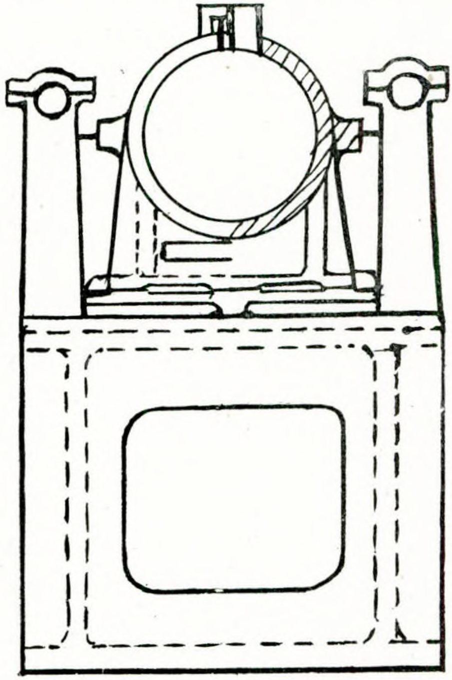

Fig. 2.

being filled with brass or tin liners. The brackets at the end of the main casting are, in this case, tapped to take a large gun-metal screw as shown. These screws bear against the forward and after shoes and provide for the rigidity of the shoes as a whole. Each particular shoe can be separately adjusted by slackening back the screws and increasing or diminishing the number of liners between it and the shoes forward and aft of it, and then tightening the screws up again.

Each of these forms of shoe calls for a different arrangement of the water supply. In 3 the water enters as shown by a pipe, passing through a boss cast for the purpose on one side of the shoe, to the bottom of that side, and escapes through a similar pipe on the other side. This arrangement is simpler and more efficient than that adopted in the other type as shown in 4. The latter involves a water-tight joint between the shoe and the main casting, which joint must be broken whenever the shoe is adjusted. Like the stud holes in the flange, the hole in the shoe must have a section of the form

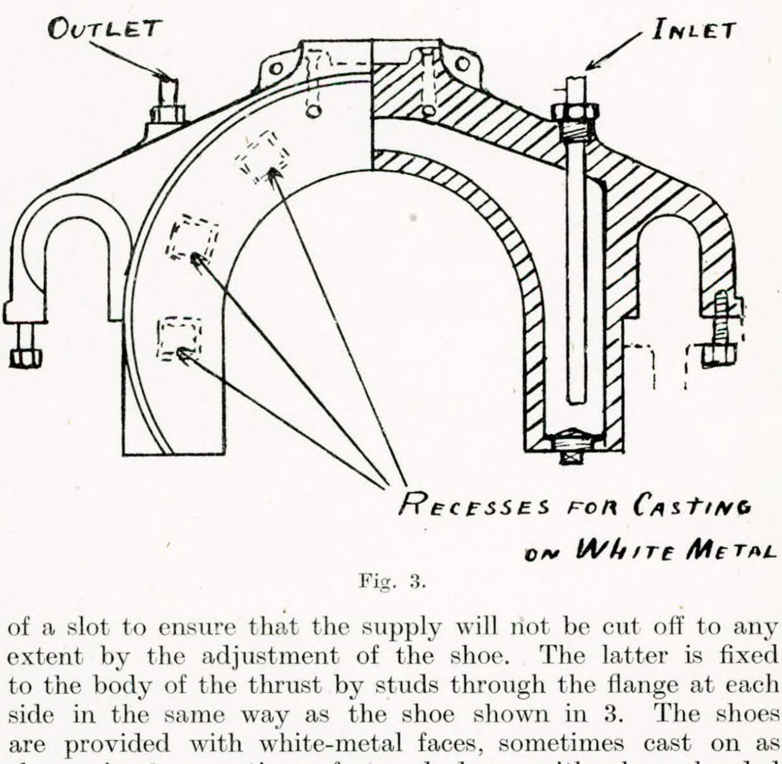

Fig. 3.

of a slot to ensure that the supply will not be cut off to any extent by the adjustment of the shoe. The latter is fixed to the body of the thrust by studs through the flange at each side in the same way as the shoe shown in 3. The shoes are provided with white-metal faces, sometimes cast on as shown in 3, sometimes fastened down with cheese-headed brass pins, the heads of the latter being sunk beneath the surface of the white metal. The best method is to fit the faces on to brass dowels screwed into the cast iron. This admits of liners being placed behind the white metal to compensate for wear. An oil-box forms part of the shoe casting, and oil gutters are cut in the white metal faces and, sometimes, in the working faces of the collars on the shaft.

In small jobs the thrust-block is sometimes bolted down to a stool built of plates and angle bars similar in construction to those provided for the tunnel blocks. In other cases the stool and block form one casting which, in addition to being bolted down to the tank top, is braced, as shown in 1, against the after end of the sole plate by cast-iron distance pieces machined to place, and is also fitted with corner chocks or a cast-iron stopper across the after end. The latter is shown in sketch 1. The type shown is somewhat similar to the above, but the stool and thrust-block are separate castings,

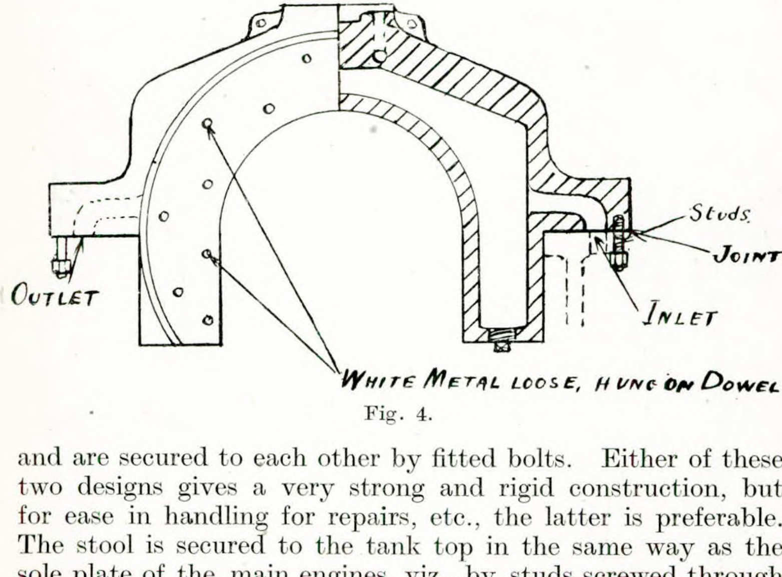

Fig. 4.

and are secured to each other by fitted bolts. Either of these two designs gives a very strong and rigid construction, but for ease in handling for repairs, etc., the latter is preferable. The stool is secured to the tank top in the same way as the sole plate of the main engines, viz., by studs screwed through the tank top and provided on the water side with grummet, washer and nut, carefully caulked after tightening up. Like the sole plate, also, the stool rests on iron chocks, one to each stud, carefully fitted after the thrust is in its proper position. Chocks of hard wood are fitted between the iron ones and help to distribute the weight of the thrust over the tank top.

Sometimes the thrust-block is in the forward end of the shaft tunnel, but usually it is placed in a recess provided for the purpose at the aft end of the engine-room. Stool and block are shipped together, complete with the shaft in position, when the tunnel shafting has been put in and before the sole plate of the main engines. The thrust is lowered on to rollers (generally lengths of 2 in. bar) in the engine-room and run into its place. In the yard, for the purpose of lining off and boring out the stern post for the stern tube, a steel wire is stretched from the centre of the hole in the stern post to a hole in the forward bulkhead of the engine-room bored at exactly the height of the centre of the crank-shaft from the tank top. The various heights of this wire

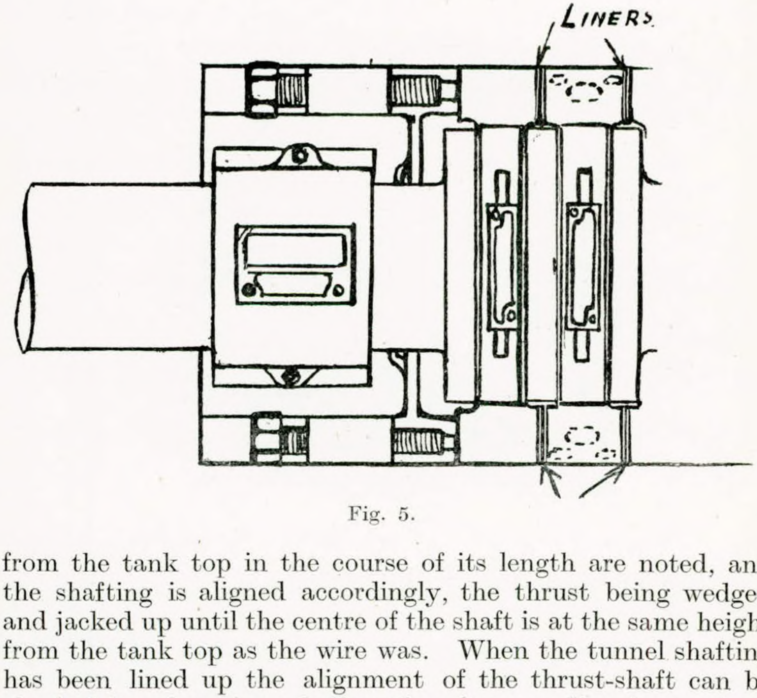

Fig. 5.

from the tank top in the course of its length are noted, and the shafting is aligned accordingly, the thrust being wedged and jacked up until the centre of the shaft is at the same height from the tank top as the wire was. When the tunnel shafting has been lined up the alignment of the thrust-shaft can be checked by observing whether the after coupling bears at all points on, and is exactly in register with, the forward coupling of the first length of tunnel shafting. The chocks are then fitted and the thrust bolted down as described.

It is not possible, within the limits of an essay such as this, to deal with this important subject very thoroughly. The writer has merely endeavoured to state the fundamental principles on which the design of the thrust-block is based, and to describe generally the types usually met with and of which he has some personal experience.

The nom de plume of the writer of this essay was "Clydeside," and after all the essays received were read by the awards committee and marks given, this was judged to be the best. On opening the envelopes containing the identification notes, it was found that the writer was Mr. R. J. Walker (Graduate), Glasgow.

The award of £2 was therefore bestowed upon him.

JAS. ADAMSON,
Convener.

"Titanic" Engineering Staff Memorial.

This Fund now amounts to £2,646. Since the publication of the list in the February issue, amounts of £5 and over have been received from the following :—

	£	s.	d.
Association of Engineers, Singapore, per Mr. Harry Butcher, Hon. Secretary	24	10	0
Collected by Capt. W. L. Stewart, 3, Fairlie Place, Calcutta	6	0	0
Collected by Mr. H. H. French, Calcutta . . .	5	0	0

The full list of steamers from which subscriptions have been received to date, is given below.

Afghanistan
Alert
Amarapoora
Anglian
Anhui
Arabia
Arabistan
Arawa
Argus
Armanistan
Ascot
Ava
Ayrshire
Bahadur
Barala
Baroda
Baron Garioch
Barrow
Beacon Grange
Beckenham
Bellona
Beltana
Berbera
Beryl
Bhamo
Blackheath
Blackrock
Borderer
Buteshire
Cadillac
Cairngorm
Caledonia
Cambria
Camio
Canadian Government Steamers :
- Aberdeen
- Curlew
- Druid
- Earl Grey
- Governor Cobb
- Lansdowne
- Lady Laurier
- Montcalm
- Stanley

Caradoc
Carpentaria
Castor
Centipede
Cervona
Ceylon
Champion
Chanda
Changsha
Chihli
China
Chindwin
Chinhua
Chinkiang
Chiswick
Chyebassa
City of Corinth
City of Edinburgh
City of Poona
City of Vienna
Cobra
Colaba
Colonia
Commonwealth
Cornelian
Crane
Culna
Cumbria
Dargai
Delaware
Demosthenes
Devon
Devona
Durham
Eden Hall
Emerald
Empire
Envoy
Epsom
Essex
Estrellano
Euphrosyne
Falls of Monero
Fatshan
Fengtien
Fingal
Fooshing
Frankmere
Fremona
Garesfield
Geelong
G.E.R. Steamers
Gibel Dersa
Gibel Kebre
Gibel Tavik
Gibel Zedid
Girasol
Glenlogan
Glenroy
Golconda
Gordonia
Guelph
Haiyang
Hampstead
Hangchow
Henzada
Heungshan
H.M.S. Amethyst
H.M.S. Black Prince
H.M.S. Canopus
H.M.S. Dartmouth
H.M.S. Defence
H.M.S. Derwent
H.M.S. Electra
H.M.S. Fervent
H.M.S. Garry
H.M.S. Gloucester
H.M.S. Implacable
H.M.S. Kestrel
H.M.S. Lightning
H.M.S. Majestic
H.M.S. Ness
H.M.S. Rattlesnake
H.M.S. Recruit
H.M.S. Renard
H.M.S. Ringdove
H.M.S. Sphinx
H.M.S. Torch
H.M.S. Zebra
H.M.T.B.D. Brazen
H.M.T.B.D.Coquette
H.M.T.B.D. Cynthia
H.M.T.B.D. Porcupine
H.M.T.B.D. Vulture
H.M.T.B.D. Zephyr
H.M.T. Boats Nos. 071, 079, 3, 6, 7, 8, 9, 10, 11, 12, 17, 18, 19, 20, 23, 30, 112, 113, 114, 115
Highland Brae
Highland Pride
Highland Warrior
Himalaya
Hindu
Henley
Hoihow
Hoisang
Honam
Horlington
Hsin Pekin
Huichow
Hunan
Hupeh
Hurona
Hurunui
Hydra
Ichang
Ilford
Inanda
India
Ingeli
Inkosi
Insizwa
Intaba

Iona
Irene
Iroquois
Irrawaddy
Islanda
Jacona
Jaffa
Jelunga
Kadett
Kaifong
Kaikoura
Kaipara
Karamea
Karanja
Kariba
Karma
Karonga
Karuma
Katuna
Khartoum
Kia Ora
Kian
Kinling
Kinshan
Kioto
Kistna
Kola
Kueichow
Kumara
Kurrachee
Kutsang
Kyanite
Lady McCallum
Lake Erie
Lake Michigan
Laura
Leversons
Lewisham
Lhassa
Liangchow
Linan
Lindula
Linga
Lintan
Lord Cromer
Luen Yi
Lunka
Mackinaw
Magnet
Makarini
Malda
Maloja
Malta
Mamari
Mandalay
Manitou
Mantua
Marmora
Martaban
Matatua
Matiana
Mazagon
Media
Mermaid
Milleped
Miltiades
Milwaukee
Mimiro
Min
Minneapolis
Minnehaha
Minnewaska
Moldavia
Mombassa
Monmouth
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Montezuma
Montfort
Montreal
Montrose
Mooltan
Morayshire
Morion
Mount Royal
Mount Temple
Muttra
Namur
Nanning
Nephrite
Ngan Kin
Nile
Ningpo
Nore
Norfolk
Nubia
Nyanza
Nyasaland
Omrah
Opawa
Ophir
Orama
Orari
Orontes
Orvieto
Osterley
Otaki
Otranto
Ottawa
Otway
Palamcotta
Palawan
Palermo
Palma
Patrol
Pera
Persia
Perthshire
Peshawur
Plasma
Plassy
Ploussa
Poona
Poyang
Prase
Prince Rupert
Prometheus

Pundua
Purnea
Putiala
Pyrope
Queda
Rakaia
Rangatira
Ready
Recorder
Remuera
Rhesus
Rio Squassa
Rotorua
Royal Edward
Royal Scot
Ruby
Sagenite
Sanui
Sard
Sardinia
Satellite
Seistan
Seldanha
Sentinel
Servian
Shantung
Shasi
Shenandoah
Shropshire
Shuntien
Siangtan
Sicilian
Simla
Singan
Siren
Socotra
Somali
Soudan
Star of Scotland
St. Albans
Stella
Sumatra
Sunda
Sungkiang
Sui-An
Sui-Tai
Suwanee
Swarka
Szechuan
Tainui
Taiyuan
Talavera
Taming
Tamsui
Tean
Tenasserim
Themistocles
Thongwa
Tongariro
Triton
Trocas
Tung-ting
Twickenham
Ula
Umballa
Umta
Umtali
Ustal
Usworth
Vadala
Volute
Wai Shing
Waimana
Waimate
Waipara
Waiwera
Wallaroo
Walter Dammayer
Warden
Warwickshire
Willesden
Wiltshire
Winlaton
Woodford
Zaida

The following were elected at a meeting of Council of the Institute held Thursday, January 30, 1913.

AS MEMBERS.

Robert Barr, Rangoon.
Charles L. Bradley, London.
Joseph Brundrit, Liverpool.
Thomas Dunlop, Reading.
Robt. W. Gammon, London.
Robt. Kingdom, Eltham.
E. E. McClintock, North Shields.
E. W. Thickins, Newport, Mon.

AS ASSOCIATE MEMBER.

Charles V. Filmer, London.

AS GRADUATE.

James Marsden, Glasgow.

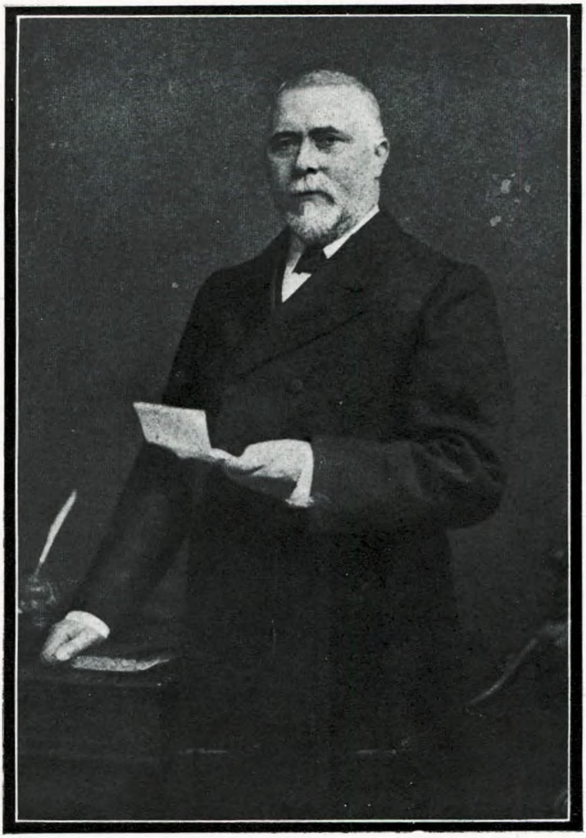
TRANSFERRED FROM GRADUATE TO ASSOCIATE.

Stanley Brown, London.

Elected as Members on February 13.

R. Crosby-Jones, London.
Jas. Macfarlane, Cowes.

SIR WILLIAM WHITE, K.C.B.*



THE sudden stroke of death has removed from the midst of his activities Sir William Henry White, K.C.B., formerly Director of Naval Construction and undoubtedly one of the greatest designers of warships whom the world has ever known. Since his retirement from the official employment of the Admiralty he has had an office in Victoria Street, Westminster, and on the 27th February he appeared to be in his usual health and attended as was his wont, at his work. When luncheon time came he rose to go out, fell back in a fainting fit, and was taken at once to the Westminster Hospital which is hard by his office. There it was found that he was suffering from a paralytic seizure and at 6.30 he passed away. His end came as a great shock to those who knew him, and they were legion. The thought that they would never see his kindly smile again or hear his

**Reprinted from the Marine Engineer and Naval Architect.*

words of encouragement was a grievous blow; but for himself no one could regret that so active a life terminated in the midst of its activities and that Sir William was spared the tedium and restraint of a long illness.

Sir William was in every sense a self-made man. He owed nothing to birth or connections, everything to his own ability, hard work and personal characteristics. Born in the year 1845, at Devonport, he was entered when fourteen years of age as an apprentice in the Royal Dockyard there. After about five years' work in the yard his first opportunity came to him. The Admiralty, after two unsuccessful attempts at establishing a school of Naval Architecture, inaugurated the Royal School at South Kensington in the year 1864. An examination being held for the candidates who came forward for entrance, young White came out at the head of the list, and during the three years during which he pursued his course there, gave further proofs of his ability and industry. In 1870 he entered the service of the Admiralty and was appointed instructor at the School of Naval Architecture. In 1875 he became assistant constructor to the Royal Navy and a year later secretary to the Council of Construction of the Royal Navy, Sir Nathaniel Barnaby being President. In 1881 he was made a chief constructor. In 1883, having left the Naval service, he undertook the organisation and management of the shipyard department of Messrs. Armstrong and Co., at Elswick. There, however, he only remained two years, for the Admiralty found they had need of him again, and back he came to the public service as Director of Naval Construction and assistant controller of the Navy.

Now came the important stage in his career. He soon made a mark which has imprinted itself, not only on the British Navy but on the fleets of every Maritime Nation in the world. He evolved the "*Admiral*" class of battleships, a type which, with the necessary alterations and developments which invention and experience have rendered possible, has been the prototype of all subsequent warships of the line. Not only were the "*Admirals*" themselves remarkable ships, but the homogeneity of the class was in itself a new thing, providing as it did a squadron of eight vessels whose tactical qualities were identical and whose use in war was consequently increased by their equality. Previous to his advent to the direction of affairs our navy had consisted of a collection of samples in which divergent ideas had been carried in some cases to extremes.

Immediately upon his appointment he had the task of expressing in ships the Northbrook programme, which was the beginning of Britain's awakening to the need for the extension of her fleet. Then under the Imperial Defence Act of 1887 there had to be provided the five protected cruisers and two torpedo gun-vessels which were sent out for permanent service on the Australian station. But the greatest undertaking was the building of the seventy warships of the Naval Defence Act of 1888, at a cost of 21½ millions sterling. Altogether when he left the service in the year 1902 on account of failure in health, he had been responsible for the design of no less than 245 warships at a cost of upwards of 100 millions of money. This fleet included :—

43	battleships
26	armoured cruisers
21	first class protected cruisers
48	second class ,, ,,
33	third class ,, ,,
74	unarmoured vessels.
245	

This total, it will be observed, is irrespective of the large number of destroyers and torpedo boats which were constructed during his tenure of office. And also let it be remembered not one vessel that he built was in any way a failure, save the *Victoria* and *Albert,* a Royal yacht, which at first was not altogether stable. Sir William with characteristic loyalty never disclaimed responsibility for this vessel, though it is well known that absurd alterations were forced upon him after the main design was settled, and fittings involving the addition of heavy weights introduced into the upper part of the ship at the suggestion of outsiders, who knew nothing of the limitations which compass the ship-designer on every side.

After his retirement, when Parliament made him a special money grant, he was consulted in regard to design of hull and machinery by the Cunard Company and by the builders of the great Cunarders which have been so successful in obtaining and retaining the blue riband of the Atlantic and became a director of Messrs. Swan, Hunter & Wigham Richardson. He was also generally engaged as a consulting naval architect in his London office.

Amongst the numerous scientific societies with which he was connected may be mentioned the Institution of Naval Architects, of which he became a member in 1871, and subsequently a vice-President ; the Institution of Mechanical Engineers, the Institute of Marine Engineers, and the Junior Institution of Engineers, of which societies he was past president. He was chairman of the Society of Arts, besides being connected with many other societies both at home and abroad. He was also a Fellow of the Royal Societies both of London and Edinburgh. In 1903 he was president of the Institution of Civil Engineers and at the time of his death was President Elect of the British Association for the Advancement of Science.

Amongst more public honours he was made C.B. in 1891, K.C.B. in 1895. He was also an LL.D. of Glasgow, D.Sc. of Cambridge and Durham. He married twice, his first wife, who was the daughter of Mr. F. Martin, a Chief Constructor in the Navy, dying in 1886, he married for the second time Miss Marshall, of Tynemouth. A family of three sons and two daughters survive to mourn his loss.
