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Phone 617.253.5136
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WILLIAM HOVGAARD, 1857-1950

Papers, 1888-1944 (bulk 1901-1930)

Manuscript Collection – MC 185

10 manuscript boxes, 1 legal-size manuscript box, 1 cassette box
4.5 cubic feet
Accession number: 1977-77

Processed: April 2006
By: Michael Thompson

ACCESS

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BIOGRAPHICAL NOTE

William Hovgaard (1857-1950) graduated from the Naval Academy at Copenhagen in 1879 and from the Royal Naval College in Greenwich, England, in 1887. He joined the staff of the Massachusetts Institute of Technology in 1901 and was professor of naval design and construction until his retirement in 1933. He was a consulting naval architect to many private companies and to several bureaus of the United States Department of the Navy. He also served as an expert witness in the investigations of the sinking of the *Titanic* and the *Lusitania*.

William Hovgaard was born in Aarhus, Jutland, Denmark, on November 28, 1857. He graduated from the Naval Academy in Copenhagen in 1879, at age 21, and was commissioned as sub-lieutenant in the Danish Navy. In 1881 he was promoted to full lieutenant. In 1882 Hovgaard was a crew member of the Danish Transit of Venus Expedition to St. Croix.

In 1883 Hovgaard entered the School of Naval Architecture at the Royal Naval College in Greenwich, England. After graduating in 1887, he moved back to Denmark. He was placed on technical duty in the Royal Dockyard at Copenhagen, where he served until 1895 as an instructor at the dockyard's School of Naval Architects and Engineers. In 1895, he was appointed yard manager of the famous Danish shipyard of Burweister & Wain. In 1897 he attained the rank of commander in the Danish navy, and in the following two years he took special courses in gunnery and torpedoes and made cruises in war vessels. During this time, he prepared a complete design of a submarine. Hovgaard later resigned his Danish naval commission in 1905.

In 1901 Hovgaard was appointed aide-de-camp to the Danish Minister of Marine, and was sent to the United States to study the newly relevant issue of submarines. Later that year, Hovgaard joined the nascent MIT Department of Naval Architecture and Marine Engineering (Course XIII-A) as director and professor of naval design. This was a graduate-level course, founded by Cecil H. Peabody, which was intended mainly (though not exclusively) for naval cadets. The courses Hovgaard most frequently taught were Warship Design, Theory of Warship Design, and History of Modern Warship Construction.

Hovgaard spent his early years at MIT helping to strengthen the Course in Naval Architecture. He designed many of the exams given to undergraduate and doctoral students of naval architecture. He also worked closely with several distinguished faculty members of Course XIII, including Cecil Peabody, Henry H. W. Keith, James R. Jack, and Carl H. Clark. Hovgaard's work reinforced the connection between the Institute and the United States Navy, and many of his students went on to careers in naval architecture and design. Among his most distinguished students were Jerome C. Hunsaker and future Rear Admiral Edward Ellsberg.

In 1915 Hovgaard was called to serve as an expert witness on behalf of the White Star Lines during the inquiry that followed the sinking of the HMS *Titanic*. Having already attained a high profile in his chosen field, he was awarded a gold medal by the British

Institution of Naval Architects for his work on the "Buoyancy and Stability of Submarines." When World War I enveloped the US in 1917, Hovgaard took a leave of absence from the Institute and began technical duty at the War Department's Bureau of Construction and Repair, where he served until the end of the war in 1918, and with which he maintained close ties throughout his career. In 1918 he served as expert witness and offered testimony in the Navy's inquest following the torpedoing of the SS *Lusitania*.

Hovgaard was naturalized as a US citizen in 1919. In addition to his naval expertise, he was by this time regarded as an authority on the subject of dirigibles and airship construction. In 1922 he was appointed by the National Advisory Committee for Aeronautics as a member of the special committee on the designs of the airships *RS-1* and *Shenandoah*.

In 1924 he was appointed chairman of a newly formed exchange program between American and Scandinavian universities. In 1925 he was commissioned by the Naval Court of Inquiry to study the aftermath of the crash of the airship *Shenandoah*, and he designed and constructed a replica keel of the airship in the MIT workshops, with MIT students.

In the years that followed, Hovgaard was as active outside the Institute as within it. In 1926 he was elected vice-president of the American Scandinavian Foundation, of which he had been a trustee since 1912. In an article published in 1927 in the *New York Times*, Hovgaard proposed a barge-like "seadrome," or anchored, floating relay platform for airplanes. That same year, he was made a Knight Commander of Dennebroge by King Christian X of Denmark.

Nineteen twenty-nine was a particularly active year for Hovgaard. He was appointed to the Department of Commerce's Committee on Ship Construction. The Polyteknisk Laeranstalt in Copenhagen awarded him the honorary degree of Doctor of Engineering. Later in 1929 he became a full member of the National Academy of Sciences. In 1930 he wrote the program notes for an exhibit at the MIT Nautical Museum entitled "A Model of the Christianus Quintus: First Three-Decker in the Danish Navy." In 1932 he was made a life member of the Society of Naval Architects and Marine Engineers.

In 1933, at age 76, Hovgaard retired from his position at the Massachusetts Institute of Technology, and was appointed professor emeritus. Henry E. Rossell succeeded him as head of Course XIII-A. Hovgaard moved to Brooklyn, New York, where he was a consulting naval architect to the Bureau of Yards and Docks at the Navy Department, and to other private concerns, including the consulting firm of Gibbs & Cox. He continued to be active as a scientist and naval authority for many years. In 1934 he addressed the Academy of Arts and Sciences in Boston regarding "Fundamentals of the Theory of Relativity," and later that year the Stevens Institute awarded him the title of Doctor of Engineering. In 1935 he was selected to analyze and make recommendations to the Secretary of the Navy regarding the future design and construction of airships.

In 1937 Hovgaard was honored at a luncheon at the Astor Hotel, under sponsorship of the American Society of Danish Engineers, the Danish Officers' Club, and the Danish Luncheon Club. A letter read at the luncheon from a US naval official noted that 85 percent of the officers in the Navy's construction corps were Hovgaard's former students, and that every one of the Navy's ships currently docked at New York Harbor was constructed under the supervision of his former pupils. Later in 1937 Hovgaard was appointed to the Navy's advisory board on plans for two new battleships. Hovgaard's health was declining by the beginning of World War II, but he was still able to write a pamphlet called "The United World," whose main premise was that the fundamental causes of war are of innate biological origin. Karl T. Compton, MIT's president, wrote the foreword to the work.

Hovgaard died in January 1950, in Summit, New Jersey. He was survived by his wife, Marie Hovgaard, his daughter, Annette Jerrald, and his son, Ole M. Hovgaard.

PROVENANCE NOTE

Folders 1 through 281 were a gift of William Hovgaard in 1947. Folders 282 through 313, containing additional materials and publications, were added in 2006 from the MIT Libraries collection.

SCOPE AND CONTENT NOTE

The William Hovgaard collection was first organized into 281 separate folders at the New York Navy Yard in 1947 before being sent to the Institute. The bulk of this collection consists of reports and memoranda drafted from 1901 to 1930 by Dr. Hovgaard for various departments of the United States Navy, most notably the Bureau of Construction and Repair, for whom he seems to have done much of his consulting research. These memos and reports mainly concern research on the design and construction of ships, submarines, and airships for the US Navy. Topics include dry docks, gun turret stresses and test firings, riveted joints, radiodynamic torpedo design, bending and breakage of beams and pipes, safety at sea, and ship disasters.

There are, however, many other topics of interest in this collection. Researchers studying the development of naval architecture will be interested in folders 118 to 121, which hold examinations given to Hovgaard at the Royal Naval College in Greenwich, England. Researchers studying MIT history in general, and Course XIII-A in particular, should examine folders 122 through 128, which hold exams given by Hovgaard to his students at the Institute. These offer an interesting comparison to the exams Hovgaard received at the Royal Naval College. Hovgaard also kept a list (folder 251) of theses on naval architecture written by MIT students, as well as his comments on those theses (folder 250). Several of the other folders contain pamphlets and articles written by Hovgaard on a variety of subjects, including his program notes for "A Model of the Christianus Quintus" (folder 145). There is a memo discussing the feasibility of long-range "burning mirrors," an idea first proposed by Archimedes, which was still being considered in 1918 (folder 155).

Historians and researchers of naval disasters will want to make special note of two folders. Hovgaard's testimony on the *Titanic* disaster, which consists of four pages of prepared testimony and correspondence, is in folder 180. His testimony on *Lusitania,* which consists of twenty-nine pages of correspondence and prepared testimony, is in folder 181.

LANGUAGES:

Collection is predominantly in English. Some early material is in Danish.

RELATED MATERIAL:

Jerome Clarke Hunsaker, Papers, 1898-1969. Manuscript Collection MC 272.

XIII-A: One Hundred Years, Massachusetts Institute of Technology. Cambridge, Mass.: Dept. of Ocean Engineering, 2000. MIT Libraries. T171 .M4224 .O248. 2000.

Baker, William A. *A History of the First 75 Years.* Cambridge, Mass.: MIT Department of Naval Architecture & Marine Engineering, 1969. MIT Libraries. VM1.M41.N31 no. 69-3

Box	Folder	Contents (O) = Oversize
1	1	Memorandum: “Anti-Rolling Ailerons”
1	2	Memorandum: “Rubberized Fabric on Airplanes”
1	3	Paper: “An Airplane Section in Mid-Atlantic”
1	4	Letters: “Strength of Airships”
1	5	Paper: “The Airship Problem”
1	6	Photostats and blueprints of various airships
1	7	Memorandum: “Preliminary Survey of the History of Airships”
1	8	Memorandum: “Wind Pressures and Other Dynamic Forces Acting on Mooring Masts for Airships”
1	9	Report: “Loss of the USS *Shenandoah*”
1	10	Prepared questions and answers to be used in connection with the hearing on the loss of the USS *Shenandoah*
1	11	Memorandum: “Loss of the USS *Shenandoah*”
1	12	Synopsis and analysis of the loss of the USS *Shenandoah*
1	13	Photostat of the last flight of the USS *Shenandoah*
1	14	Memorandum: “Loss of the USS *Macon*,” and letter from Jerome C. Hunsaker
1	15	Abstract of revised report on the accident to HM Airship R-38
1	16	Article: “Water Models for Aeronautical Tests” with photostats
1	17	Report: “Water Model RS-1”
1	18	Memorandum: “Proposed Model of Fleet Airship No. 1”
1	19	Report: “Report on Experiments with Airship Models”
11	20(O)	Report: “Report on Test of Model of Airship RS-1”
1	21	Article: “Bending of a Quasi-Ellipsoidal Shell with Special Reference to Rigid Airships”

Box	Folder	Contents (O) = Oversize
1	22	Report: “Rigid Airship ZR-1”
1	23	Memorandum: Special Committee on Rigid Airship ZR-1, Memo #1, “The Longitudinal Strength of Rigid Airships,” 29 August 1922
1	24	Memorandum: Special Committee on Rigid Airship ZR-1, Memo #2, “Longitudinals and Transverse Shears,” 22 September 1922
1	25	Memorandum: Special Committee on Rigid Airship ZR-1, Memo #3, “Further Development of the Bending Method,” 17 October 1922
1	26	Report: “Report of Special Committee on Rigid Airship ZR-1” and Preliminary Statement of Committee’s Findings
1	27	Paper: “The Longitudinal Strength of Rigid Airships”
1	28	Memorandum: “The General Strength of Rigid Airships”
1	29	Memorandum (Draft): “Longitudinal Strength of Airships”
2	30	Memorandum (Draft): “Studies and Calculations on Connection with ZR-1”
2	31	Memorandum: “The General Strength of Rigid Airships,” further investigations
2	32	Memorandum: “Strength of Semi-Rigid Airships”
2	33	Memorandum: Appendix I, 24 May 1923, “Elongation and Contraction of the Suspension Cable”
2	34	Memorandum: Appendix II, 2 June 1923, “Nose Stiffening”
2	35	Memorandum: “Statical Longitudinal Stability of Semi-Rigid Airships, with Special Reference to RS-1”
2	36	Memorandum: “Calculations of the Longitudinal Strength of RS-1”
2	37	Memorandum: “Stresses Caused by Variation in Superpressures”
2	38	Memorandum: “Increase in Flexibility of the Keel”

Box	Folder	Contents (O) = Oversize
2	39	Article: “Adjustment of the Elastic Properties of a Modern Keel, US Army Airship RS-1”
2	40	Correspondence pertinent to the development and design of semi-rigid airship RS-1 (Special Committee), with letter from Jerome C. Hunsaker
2	41	Report: “Voyage With the Airship *Hindenburg*, Sept. 21 to 24, 1936 and Visit to Friedrichshafen, Sept. 24 to 26, 1936”
2	42	Memorandum: “An Analysis of the Anchor Windlass of the USS *Tennessee*”
2	43	Letter: “World Organization of Armaments,” sent to *New York Times* editorial department
2	44	Paper: “The Relation Between Armament and Protection in the 10,000-Ton Cruisers and the *Ersatz-Preussen*”
2	45	Memorandum: “Protection of Openings in Armor Decks”
2	46	Memorandum: “Data for Battle Condition”
2	47	Memorandum: “Material for Torpedo Bulkheads”
2	48	Paper: “An Analysis of Tests of Water-Tight Bulkheads With Practical Rules and Tables for Their Construction”
2	49	Patent certificate no. 1164814: “Elastic Bulkheads”
2	50	Correspondence: “Preventing the Shifting of Bulk Cargo”
11	51(O)	Article: “A Proposed New Type of Conning Tower for Large Battleships”
2	52	Paper: “The Cruiser”
2	53	Memorandum: “Structural Design of Destroyer Leader”
2	54	Memorandum: “Analysis of Deck Plating Tests”
2	55	Memorandum: “Design of Protective Decks”

Box	Folder	Contents (O) = Oversize
2	56	Memorandum: “Deck Stanchions—*Maryland* (46) and *West Virginia* (48)
2	57	Memorandum: “Analysis of Tests of Deck Target Models”
2	58	Memorandum: “Exact Determination of the Displacement of Ships With Special Regard to the Buoyancy Produced by the Atmosphere”
2	59	Paper: “Exact Determination of the Displacement of a Ship”
2	60	Patent certificate no. 9815, Denmark: “Improved Method of and Apparatus for Distilling Sea Water and Other Liquids”
3	61	Memorandum: “Tests of Keel Blocks Used in Docking”
3	62	Memorandum: “Docking Stresses”
3	63	Memorandum: “Failure of Keel Blocks in a Dry Dock”
3	64	Memorandum: “Distribution of Blocking Under Modern Battleships in Dock With Special Regard to the Emergency Condition”
3	65	Memorandum: “Contract NOy-2500, Model Test, Floating Dry Dock ARD-3; Comment on Final Report”
3	66	Memorandum: Floating Dry Dock Memo #1, “Longitudinal Strength Calculations for Floating Dry Dock—General Assumptions”
3	67	Memorandum: Floating Dry Dock Memo #2, “Method of Calculating Maximum Stresses and the Use of High Tensile Steel”
3	68	Memorandum: Floating Dry Dock Memo #3, “Multi-Sectional Floating Dock”
3	69	Memorandum: Floating Dry Dock Memo #4, “Strength and Stiffness of the Walls”
3	70	Memorandum: Floating Dry Dock Memo #5, “Torsional Moments”
3	71-72	Memorandum: Floating Dry Dock Memo #6, “Loading Assumptions for the Design of the Bottom Pontoon” and Memorandum: Floating Dry Dock Memo #7, “Various Structural Problems”
3	73	Memorandum: Floating Dry Dock Memo #8

Box	Folder	Contents (O) = Oversize
3	74	Memorandum: Floating Dry Dock Memo #9
3	75	Memorandum: Floating Dry Dock Memo #10, “Thickness of Bottom Plating”
3	76	Memorandum: Floating Dry Dock Memo #11, “Measurements of Strains and Deflections”
3	77	Memorandum: Floating Dry Dock Memo #13, “Transverse Girders and Plating of Cellular Bottom”
3	78	Memorandum: Floating Dry Dock Memo #14, Strains and Deflections—Supplement to Memo #11”
3	79	Memorandum: Floating Dry Dock Memo #15, “Elastic Stability of the Walls of ARD-3 in Sagging”
3	80	Memorandum: Floating Dry Dock Memo #16, “ARD-3, Comments on Various Drawings”
3	81	Memorandum: Floating Dry Dock Memo #17, Comments to Final Report of Professor George E. Beggs on Floating Dry Dock ARD-3—Model Analysis
3	82	Memorandum: Floating Dry Dock Memo #18, “Permissible Stresses and Sea Moments—Strategic Value”
3	83	Correspondence and photographs relating to the development and design of Floating Dry Dock ARD-3, 1936-1938
3	84	Note: List of plans for Floating Dry Dock ARD-3
11	85(O)	Memorandum: “USS *Mount Vernon*—Effects of Bilging”
3	86	Memorandum: “USS *America*—Effects of Bilging”
11	87(O)	Memorandum: “USS *Mercury*—Effects of Bilging”
3	88	Memorandum: “USS *Pocahontas*—Effects of Bilging”
3	89	Memorandum: “USS *Siboney*—Effects of Bilging”
3	90	Memorandum: “USS *Covington*—Effects of Bilging”
3	91	Memorandum: “USS *Leviathan*—Effects of Bilging”

Box	Folder	Contents (O) = Oversize
3	92	Memorandum: “USS *Mallory*—Effects of Bilging”
3	93	Memorandum: “USS *Lake Placid*—Effects of Bilging”
3	94	Memorandum: “USS *Calamares* & Class—Effects of Bilging”
3	95	Memorandum: “USS *Great Northern* and *Northern Pacific*—Effects of Bilging,” 20 June 1918
11	96(O)	Memorandum: “USS *President Grant*—Effects of Bilging”
3	97	Memorandum: “USS *Mount Vernon*—Effects of Bilging”
3	98	Memorandum: “USS *Great Northern* and *Northern Pacific*—Effects of Bilging”
3	99	Memorandum: “*Santa Teresa*, *Santa Lucia* and *Santa Elsa*—Effects of Bilging”
3	100	Memorandum: “USS *Rijndam*—Effects of Bilging”
4	101	Memorandum: “USS *Lenape*—Effects of Bilging”
4	102	Memorandum: “USS *Madawaska*—Effects of Bilging”
4	103	Memorandum: “USS *Louisville* and *St. Paul*—Effects of Bilging”
4	104	Memorandum: “USS *Luckenbach*—Effects of Bilging”
4	105	Memorandum: “USS *Susquehanna* and *Antigone*—Effects of Bilging”
4	106	Memorandum: “USS *Kroonland* and *Finland*—Effects of Bilging”
4	107	Memorandum: “USS *Mongolia* and *Manchuria*—Effects of Bilging”
4	108	Memorandum: “USS *George Washington*—Effects of Bilging”
4	109	Memorandum: “USS *Martha Washington*—Effects of Bilging”
4	110	Memorandum: “USS *Aeolus*—Effects of Bilging”
4	111	Memorandum: “USS *Rijndam*—Effects of Bilging,” 9 September 1918

Box	Folder	Contents (O) = Oversize
4	112	Memorandum: “USS *De Kalk*—Effects of Bilging”
4	113	Memorandum: “USS *Huron*—Effects of Bilging”
4	114	Memorandum: “USS *Powhatan*—Effects of Bilging”
4	115	Memorandum: “USS *Zeelandia*—Effects of Bilging”
4	116	Blueprints: “USS *Harrisburg* and USS *Plattsburg*—Effects of Bilging”
4	117	Memorandum: “USS *Matsonia* and *Maui*—Effects of Bilging”
4	118	Royal Naval College Examinations: Session 1883-1884
4	119	Royal Naval College Examinations: Session 1884-1885
4	120	Royal Naval College Examinations: Session 1885-1886
4	121	Royal Naval College Regulations, 1878
4	122	Examination papers, Massachusetts Institute of Technology
5	123	Examination papers, Massachusetts Institute of Technology
5	124	Examination papers, Massachusetts Institute of Technology
5	125	Examination papers, Massachusetts Institute of Technology
5	126	Examination papers, Massachusetts Institute of Technology
5	127	Examination papers, Massachusetts Institute of Technology
5	128	Examination papers, Massachusetts Institute of Technology
5	129	Paper: “The Principle of Minimum Energy and the Motion of Fluids”
5	130	Memorandum: “Strength of Funnel Structure in Airplane Carriers”
5	131	Correspondence on turret stresses
5	132	Report: “Stresses in Structure Under Turrets in 10,000-Ton Light Cruisers”

Box	Folder	Contents (O) = Oversize
5	133	Report: “Stresses in Two-Gun Turrets for 16-Inch Guns”
5	134	Memorandum: “Stresses in Gun Turrets”
5	135	Memorandum: “Stresses in Gun Turrets”
5	136	Memorandum: “Observations and Measurements to Be Made During Firing Trials in a Triple 14-Inch Gun”
5	137	Memorandum: “Measurements of the Motions of the Turrets and Turret Structures During the Structural Test Firing of the USS *Tennessee”*
5	138	Memorandum: “Stresses in Gun Turrets”
5	139	Memorandum: “Analysis of Gun Turret Tests, USS *California*—1923”
5	140	Memorandum: “Experimental Firing at the USS *North Dakota*”
5	141	Memorandum: “Analysis of Experimental Firing Against Turret No. 2 of USS *North Dakota* on May 1, 1924”
5	142	Memorandum: “Stresses in Gun Turrets—Analysis of Firing Trials on USS *California*—Single Gun Salvos—The Turning Gear”
5	143	Memorandum: “Analysis of Firing Trials—USS *California*—Single-Gun Salvos—The Turning Gear,” preliminary
6	144	Letters regarding stresses in gun turrets—Experimental firing at the USS *North Dakota*
6	145	MIT exhibit program: “A Model of *Christianus Quintus*, First Three-Decker in the Danish Navy”
6	146	Article reprint: “The Arsenal in Piraeus and the Ancient Building Rules”
6	147	Memorandum: “Hydraulic Cylinders”
6	148	Letter: Comments and recommendations regarding a potential National Hydraulic Laboratory
6	149	Memorandum 1: “Inclining Experiments”

Box	Folder	Contents (O) = Oversize
6	150	Memorandum 2: “Inclining Experiments”
6	151	Memorandum: “The Integraph”
6	152	Memorandum: “Limiting R.P.M. For a Shaft or Disc”
6	153	Memorandum: “The Liverpool Point”
6	154	Memorandum: “Reduction of Temperature in Magazine Spaces”
6	155	Memorandum: “Burning Mirrors”
6	156	Memorandum: “Method of Calculating Moments of Inertia or Ships Sections”
6	157	Article: “Naval Strategy in a War Between England and Germany” (1911)
6	158	Memorandum: “Safety of Oil Tank Vessels in the War Zone”
6	159	Memorandum: “Use of Sulphuric Acid for Pickling Plates”
6	160	Memorandum: “Size of Air-Escape Pipes”
6	161	Paper: “Further Research on Pipe Bends”
6	162	Article reprint: “The Elastic Deformation of Pipe Bends”
6	163	Article reprint: “Information of Plane Pipes and Further Research on Pipe Bends”
6	164	Article reprint: “Tests of High-Pressure Pipe Bends”
6	165	Article reprint: “Stresses in Three-Dimensional Pipe Bends”
6	166	Memorandum: “Material of Piping for Fresh Water and Salt Water Lines”
6	167	Memorandum: “Recommendations for Repairs to the Bottom of USS *Kanawha*”
6	168	Paper: “An Analysis of the Resistance of Ships”
6	169	Memorandum: “Experiments on Riveted Joints,” preliminary

Box	Folder	Contents (O) = Oversize
6	170	Memorandum: “Tests of Riveted Joints,” preliminary
6	171	Memorandum: “An Analysis of Tests Made By the Bureau of Standards of Riveted Joints”
6	172	Memorandum: “Analysis of German Riveting Specifications”
6	173	Memorandum: “Riveting of Protective Side Plating on 10,000-Ton Light Cruisers”
6	174	Memorandum: “Flettner’s Rudder”
6	175	Memorandum: “External Rudder Yoke”
6	176	Booklet: “International Conference on Safety of Life at Sea—1929 Convention and Final Act”
6	177	Booklet: “International Conference on Safety of Life at Sea—Statement of Requirements Relating to Construction and Life-Saving Appliances”
6	178	Letters: regarding appointment to Investigatory Committee for International Conference on Safety of Life at Sea
6	179	Letters: Relating to preliminary work of Ships Construction Committee for International Conference on Safety of Life at Sea
11	180(O)	Letters and testimony regarding sinking of HMS *Titanic*
11	181(O)	Letters and testimony regarding sinking of USS *Lusitania*
7	182	Memorandum: “Loss of *City of Athens*”
7	183	Memorandum: “Loss of *President Lincoln*”
7	184	Memorandum: “Stability of *Mount Vernon*, *America* and *Covington*”
11	185	Article: “The Stability of Ocean-Going Passenger Ships” (O)
7	186	Correspondence: “Periods of Roll and Pitch”
7	187	Memorandum: Rules and requirements to secure “The Stability of Ocean-Going Passenger Ships”

Box	Folder	Contents (O) = Oversize
7	188	Memorandum: “Stability of Ex-German Ships”
7	189	Memorandum: “Stability of Ex-German Ships. Centerline Bulkheads in *Vaterland* and *Kronprinzessin Cecilie*”
7	190	Memorandum: “Stability of Ex-German Ships *Antigone* (*Neckar*) and *Susquehanna* (*Rhein*)
7	191	Memorandum: “Dr. W.P. Jenney’s Method Calculating the Period of Oscillation of a Ship”
7	192	Memorandum: “Loading and Stability of Oil Tankers”
7	193	Memorandum: “Stability of Ex-German Ships Used As Troop Transports”
7	194	Memorandum: “Proposed Letter to the Commanding Officers of US Oil Tankers Concerning the Best Mode of Ballasting Under War Conditions and of Minimizing the Effects of Underwater Damage”
7	195	Memorandum: “Oil Tankers, Type No. 208 and 209, Built By Newport News Shipbuilding & Dry Dock Co. for the US Shipping Board, Emergency Fleet Corp.”
7	196	Memorandum: “Strength and Seaworthiness of Car Float No. 2244 Built By Manitowoc Shipbuilding & Dry Dock Co.”
7	197	Memorandum: “W.T. Donnelly’s Method of Rendering Ships Unsinkable: Application of Method to SS *Lucia*”
7	198	Memorandum: “USS *Quincy*—Watertight Subdivision and Ballasting”
7	199	Memorandum: “Comments on First Report of the Special Committee on Loading and Stability—New Passenger Ships”
7	200	Memorandum: “Program for Combined Steering-Gear Tests, Turning, and Maneuvering Trials in the USS *New Mexico*”
7	201	Memorandum: “An Analysis of the Rudder and Turning Trials of USS *New Mexico*”
7	202	Memorandum: “Remarks on Various Features of the US Battleship *Tennessee*”

Box	Folder	Contents (O) = Oversize
7	203	Memorandum: “An Analysis of the Steering-Gear in US Battleship *Tennessee*”
7	204	Memorandum: “On the Steering Gear Tests on USS *West Virginia* Aug. 29 to Sept. 2, 1924”
7	205	Memorandum: “Strength Calculation of Sternpost of USS *Chester*”
7	206	Article reprint: “The Strategic Situation in the Baltic”
7	207	Article reprint: “Some Strategical Sketches”
7	208	Article reprint: “The Stress Distribution in Longitudinal Welds and Adjoining Structures”
7	209	Article reprint and letters: “Stresses and Deflections in Large Dynamo Frames”
7	210	Paper: “Bending of Curved Pipes”
7	211	Article: “Analysis of Strain Measurements & Polar Diagrams for Plane Stress”
7	212	Article reprint, annotated: “Determination of the Stresses in a Beam By Means of the Principle of Least Work”
7	213	Article reprint: “A New Proof of the Theory of Ordinary Bending and Its Extension to Beams of Non-Homogenous Materials”
7	214	Paper: “Determination of the Stresses in a Beam By the Method of Variation”
7	215	Paper: Y.C. Yeh, “The Distribution of Stresses in Welded Structure”
7	216 and 217	Article reprint: “The Stress Distribution in Welds” and article reprint: “The Stress Distribution in Welded Overlapped Joints”
7	218	Article reprint: “The Distribution of Stresses in Welded and Riveted Connections”
7	219	Article reprint with two plates: “Strength of Knees and Brackets at Ends of Beams & Stiffeners”
7	220	Memorandum: “Structural Strength and Oil-Tightness of Oil Tankers With Special Reference to the USS *Kanawha* and Class”

Box	Folder	Contents (O) = Oversize
7	221	Memorandum: “Scout Cruisers Nos. 4 to 6—Structural Strength”
7	222	Memorandum: “Calculation By Marsec’s Method of the Strength of a Closed-Frame Ship”
7	223	Memorandum: “Investigation of Stresses in the Airplane Carriers By the Photo-Elastic Method”
7	224	Memorandum: “Strength of Bottom Structure 10,000-Ton Cruisers”
7	225	Memorandum: “Strength of Bottom Structure in Light Cruisers #24 and 25 (10,000-Ton Light Cruisers)”
7	226	Paper: “Safety of Submarines”
7	227	Article reprint: “The Military Value of Submarines”
7	228	Article: “Present Status of Submarine Boats”
7	229	Paper: “Proposed Designs for Surface-Boats and Diving Boats”, 1888
7	230	Correspondence with Rear Admiral W.D. MacDougall: “Submarines V-4, V5 and V-6 (SM1, SC1, SC2) Strength of Frame Sections”
8	231	Article reprint: “Submarine Boats”
8	232	Correspondence: Letter from Bureau of Construction and Repair regarding “Submarine Design”
8	233	Memorandum: “Mine-Laying Submarines—Airplane Chamber Door”
8	234	Memorandum: “Submarines S-18 to S-41—Watertight Staples Around Central Frames on Tank Tops”
8	235	Memorandum: “Examination of Portfolio Addressed to Consul General G.M. Bryde”
8	236	Memorandum: “Strength Calculations For Submarines”
8	237	Memorandum: Strength Calculations for Dished Bulkheads of Submarines”

Box	Folder	Contents (O) = Oversize
8	238	Memorandum: “The Strength of Submarines of Circular Cylindrical Shape Stiffened by Frames and Bulkheads”
8	239	Memorandum: “Cylindrical Dish in Bulkheads of Submarines”
8	240	Memorandum: “Strength of Submarines,” preliminary
8	241	Memorandum: “The Strength of Submarines of Circular Cylindrical Shape Stiffened by Frames and Bulkheads. Experiments and Practical Application of the Theory Given in Memo #88”
8	242	Memorandum: “Comments on Prof. Flamm’s Memorandum and on Information from the German Admiralty Regarding German Submarines”
8	243	Memorandum: “Strength of Inner Hull of Fleet Submarines V-5 and V-6 in Way of Bump for Main Motors”
8	244	Memorandum: “Strength of Submarines V-5 and V-6: Preliminary for Memo #117,” preliminary notes
8	245	Memorandum: “Strength of Hull In Vicinity of Main Motors of Submarines V-5 and V-6”
8	246	Memorandum: “Hilber and Kaplan’s Calculations for Memo #117: Strength of Submarines V-5 and V-6”
8	247	Memorandum: “Frahm’s Anti-Rolling Tanks”
8	248	Memorandum: “Memo on an Experimental Model Tank for the Massachusetts Institute of Technology”
8	249	Memorandum: “Procedure for Tests of Riveted Joints”
8	250	Memorandum: “Comments on Theses of Naval Students at MIT—Course XIII-A”
8	251	List of MIT Course XIII-A theses: years and authors
11	252(O)	Article: “The Seaworthiness of Torpedo Boats”
8	253	Contract for services in connection with the development of a radiodynamic torpedo, 1921
8	254	Memorandum: “Memo #1: Radiodynamic Torpedo—Model #2347”

Box	Folder	Contents (O) = Oversize
8	255	Memorandum: “Memo #2: Radiodynamic Torpedo—Model #2347”
8	256	Memorandum: “Memo #3: Radiodynamic Torpedo—Model #2347”
8	257	Memorandum: “Memo #6: Radiodynamic Torpedo—Model #2347”
8	258	Report: “Description and Specifications of the Radio-Dynamic Torpedo”
8	259	Note: “Blueprints—see separate folder”
8	260	Memorandum: “Radiodynamic Torpedo Unit”
9	261	Article reprint: “Torsion of Rectangular Tubes”
9	262	Memorandum: “On the Use of Torsion Meters for Measuring the Twisting Moment in Rudder Stocks”
9	263	Report: “Automatic Towing Engine”
9	264	Correspondence with Commander C.M. Simmers: “Automatic Towing Engines”
9	265	Memorandum: “High Speed Towing Target”
9	266	Memorandum: “Research on Maneuvering Trials”
9	267	Memorandum: “SS *Moosehead*: Conversion to Troop Transport for Cross-Channel Service”
9	268	Memorandum: “USS *Hancock*: Watertight Subdivision; Suitability As a Troop Transport
9	269	Memorandum: “Status of Work in Connection With Safety of Troop Transports”
9	270	Memorandum: J.W. Bates, “Turning Circles”
9	271	Memorandum: “Turning Circles of New 10,000-Ton Cruisers,” preliminary
9	272	Memorandum: “Turning Circles of New 10,000-Ton Cruisers”

Box	Folder	Contents (O) = Oversize
9	273	Memorandum: “Correction of Transverse and Longitudinal Inclinations Caused By Underwater Damage”
9	274	Memorandum: “Correction of Transverse and Longitudinal Inclinations Caused By Underwater Damage—Battleships Nos. 36-42”
9	275	Notes and preliminary studies on the effects of underwater explosions—original destroyed on 27 October, 1947
9	276	Memorandum: “Effects of Underwater Explosions—Fundamental Considerations”
9	277	Memorandum: “Effects of Underwater Explosions”
9	278	Article reprint: “Effects of Underwater Explosions”
9	279	Memorandum: “Analysis of Underwater Explosions—Tests on BB-47”
9	279a	Article: “Underwater Vessels,” Russian translation
9	280	Article reprint: “Is War Inevitable?”
9	281	Article reprint: “Is War Inevitable?” reprinted in *Albatross* magazine with editor’s comments
10	282	List of Professor Hovgaard’s articles and papers
10	283	Article reprint: “Overfladebaade”, 1888
10	284	Article reprint: “Proposed Designs for Surface-Boats and Diving Boats,” 1888
10	285	Booklet: “Storebaelts Forsvar,” 1893
10	286	Booklet: “Agersøstillingen,” 1893
10	287	Article reprint: “Die Seetüchtigkeit der Torpedoboote,” 1899
10	288	Article reprint: “Strength of Elliptic Sections Under Fluid Pressure,” 1900
10	289	Article reprint: “Water-Tight Subdivisions of Warships,” 1903

Box	Folder	Contents (O) = Oversize
10	290	Paper: “The Sea-Going Battleship,” 1904
10	291	Paper: “The Cruiser,” 1905
11	292(O)	Article reprint: “Fate of the Russian Ships at Tsushima,” 1906
10	293	Paper: “On the Speed of Battleships,” 1907
10	294	Paper: “Analysis of the Resistance of Ships,” 1908
10	295	Paper: “Strength of Water-Tight Bulkheads,” 1909
10	296	Paper: “Analysis of Tests of Water-Tight Bulkheads,” 1910
10	297	Article reprint: “Scandinavian-Americans and Their Home Countries”
10	298	Article reprint: “Naval Strategy in a War Between England and Germany,” 1911
10	299	Article reprint: “Kortfattet—Den Amerikansk-Skandinaviske,” 1914
10	300	Article reprint: “Submarine Boats,” 1916
10	301	Article reprint: “Some Strategical Sketches,” 1917
10	302	Paper: “Buoyancy and Stability of Troop Transports,” 1919
10	303	Paper: “Calculation of the Transverse Strength of Submarines by Marbec’s Method,” 1921
10	304	Article Reprint: “Principle of Minimum Energy,” 1923
10	305	Paper: “Theory of Bending,” 1923
10	306	Article reprint: “Norsemen in Greenland,” 1925
10	307	Article reprint: “Arsenal in Piraeus and the Ancient Building Rules,” 1926
10	308	Article reprint: “Determination of the Stresses in a Beam by the Method of Variation,” 1928
10	309	Paper: “Relation Between Armament and Protection,” 1929

Box	Folder	Contents (O) = Oversize
10	310	MIT exhibit program reprint: "A Model of *Christianus Quintus*, First Three-Decker in the Danish Navy," 1930
10	311	Article reprint: "Ritz's Electrodynamic Theory," 1932
10	312	Article reprint: "Biographical Memoir of George Fillmore Swain, 1857-1931"
10	313	Booklet: "The United World, with a Foreword by Karl T. Compton," 1944
11		Contains oversize folders 20, 51, 85, 87, 96, 180, 181, 185, 252, 292
12		Original index card finding aid for William Hovgaard collection, 1947

APPENDIX 1: William Hovgaard, 1857-1950: A Bibliography

A. Books

Books on Naval Architecture

1887 *Submarine Boats.* E.&F. Spon, Ltd. London. 98pp.

1891 Lectures on Technology. Royal Dockyard. Copenhagen. 195pp.

1915 Structural Design of Warships. E.&F. Spon, Ltd. London. 384pp.

1920 Modern History of Warships. E.&F. Spon, Ltd. London. 514pp.

1920 General Design of Warships. E.&F. Spon, Ltd. London. 307pp.

Books on Non-Naval Architecture Subjects

1887 Sundhed eller Kundskaber. Emil Bergman. Copenhagen. 80pp.

1888 Sport. Emil Bergman. Copenhagen. 174pp.

1914 The Voyages of the Norsemen in America. American Scandinavian Foundation.New York. 304pp.

B. Papers, Articles and Pamphlets

Danish Tidsskrift for Sövaesen

1889 “Vore Torpedobaades Södygtighed”

1893 “Om at befastest Stöttepunkt for vor Flaade I Store Baelt”

1893 “Agersöstillingen”

1893 “Storebaelts Forsvar”

1894 “Den nye Ordning af det franske Söminevesen”

1894 “Sökrigen I Östasien”

1899 “Undervandsbaade”

1900 “Strategi og Folkesemning”

1911 “De maritime-strategiske Forhold under en Krig mellem England or Tyskland”

Institute of Naval Architects, London

1888 “Proposed Designs for Surface Boats and Diving Boats”

1900 “The Strength of Elliptic Sections Under Fluid Pressure”

1901 “Motion of Submarine Boats in the Vertical Plane”

1908 “An Analysis of the Resistance of Ships”

1909 “Diverging Waves”

1912 “Turning Circles”

1917 “Buoyancy and Stability of Submarines” (Awarded Gold Medal)

1923 “The Theory of Bending”

1926 “Inclining Experiments With Ships of Small or Negative Stability”

1927 “Deformation and Stress Distribution in Rigid Airships”

1929 “The Relation Between Armament and Protection in the 10,000-ton Cruisersand the Ersatz-Prussen”

1931 “A New Theory of the Distribution of Shearing Stresses in Riveted and Welded Connections and Its Application to Discontinuities in the Structure of a Ship”

The Society of Naval Architects and Marine Engineers, New York

1903 “Watertight Subdivision of Warships”

1904 “The Seagoing Battleship”

1905 “The Cruiser”

1907 “The Speed of Battleships”

1909 “The Strength of Watertight Bulkheads”

1910 “An Analysis of Tests of Watertight Bulkheads”

1919 "Buoyancy and Stability of Troop Transports"

1921 "Calculation of the Transverse Strength of Submarines by Marbec's Method"

1922 "The Longitudinal Strength of Rigid Airships"

1931 "Determination of Stresses in Plating from Strain Measurements"

Jane's Fighting Ships, Portsmouth, England

1906 "The Fate of the Russian Ships at Tsushima"

1908 "Proposed New Type of Conning-Tower for Large Battleships"

1909 "Protection of Battleships Against Submarine Attack"

Marine Rundschau, Berlin, Germany

1893 (December) "Die Vertheidigung des Grossen Belts"

Mittheilungen aus dem Gebiete des Seewesens, Pola Austria

1899 "Die Seetüchtigkeit der Torpedoboote"

Ingeniören, No.32

1900 "Styrken af elliptiske Sektioner under uvendigt Vädsketryk"

Engineering, London

1889, July 26. "The Seaworthiness of Torpedo Boats"

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1912, May 24. "Watertight Subdivision of Liners"

1915, Sept. 3. "A Lesson from the *Lusitania* Disaster"

1916, Dec. 15, 22, 29. "The Naval War and the Size of Battleships"

1927, Aug. 19."An Airplane Station in the Mid-Atlantic"

1929, April 19. "The Stability of Ocean-Going Passenger Ships"

U.S. Naval Institute

1911, March. "Naval Strategy in a War Between England and Germany"

1917, Feb. "Some Strategical Sketches"

1936, March. "Airships for Naval Service"

1937, Oct. "Is War Inevitable?"

Translations into English for the Nautical Meterological Annual, Danish Meteorological Institute

1899-1902 "The State of the Ice in the Arctic Seas"

1900 "Wind Charts, North Atlantic and Davis Strait," V. Garde

1901 "Some Investigations Relating to the Ocean Currents in the Sea Between Norway, Scotland and Greenland," C. Ryder

Proceedings of the National Academy of Sciences, U.S.A.

1923, Nov., Vol.9, No.11	"The Principle of Minimum Energy and the Motion of Fluids"
1927, Feb., Vol.13, No.4	"Bending of a Quasi-Ellipsoidal Shell With Special Reference to Rigid Airships"
1930, Nov., Vol.16, No.11	"The Stress Distribution in Welds. – The Stress Distribution in Welded Overlapped Joints"
1931, June, Vol.17, No.6	"The Distribution of Stresses in Welded and Riveted Connections"
1934, Vol.1, No.1	"An Investigation of Stresses in Longitudinal Welds"
1936, June, Vol.22, No.6	"Torsion of Rectangular Tubes"

Journal of Mathematics and Physics, Massachusetts Institute of Technology

1923, Dec., Vol.II, No.4 "A New Proof of the Theory of Ordinary Bending and Its Extension to Beams of Non-Homogenous Materials"

1925, April, Vol.IV, No.2 "Determination of the Stresses in a Beam By Means of the Principle of Least Work"

1925, Dec., Vol.V, No.1 "Adjustment of the Elastic Properties of a Model Keel, United States Army Airship RS-1"

1926, Nov., Vol.VI, No.2 "The Elastic Deformation of Pipe Bends"

1928, Oct., Vol.VII, No.3 "Deformation of Plane Pipes"

1928, Dec., Vol.VII, No.4 "Further Research on Pipe Bends"

1929, Dec, Vol.VIII, No.4 "Tests of High-Pressure Pipe Bends"

1932, Dec., Vol.XI, No.4 "Ritz's Electrodynamic Theory"

1934, Vol.XIII, No.2 "The Stress Distribution in Longitudinal Welds and Adjoining Structures"

International Congress of Mathematics, Bologna, 1928

Proceedings, Vol. VI "Determination of the Stresses in a Beam by the Method of Variation"

World Engineering Congress, Tokyo, 1929

Proceedings, Vol. III "Deflections and Stresses in Pipe Bends"

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Zeitschrift für Angewandte Mathematik und Mechanik

1930, Band 10 "Bestimmang von Balkenspannungen mit Hilfe der Variationsvechnung"

1931, Band 11 "Die Spannungsverteilung in Schweissungen"

Isis

1926, Vol. VIII, I, No. 25, Brussels "The Arsenal in Piraeus and the Ancient Building Rules"

Science

1930, Vol. LXXI "Theoretical Mechanics in Engineering Schools"

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American Society of Mechanical Engineers

1935, Oct. *Transactions*: Stresses in Three-Dimensional Pipe Bends

1936, July *Transactions*: Discussions to Three-Dimensional Pipe Bends

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1915, Vol.5, No.3 "Present Status of Submarine Boats"

The Scandinavian American

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New York Evening Post

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American-Scandinavian Review

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1882 "Venuspassagen"

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The Nautical Museum Massachusetts Institute of Technology

"A Model of the Christianus Quintus: First Three-Decker in the Danish Navy"

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1944, August "The United World," foreword by Karl T. Compton (President, MIT)

National Academy of Sciences

1937, Vol. XVII "Biographical Memoir of George Fillmore Swain, 1857-1931"

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Reviews

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1882, April 5, Dannebrog: "Lord Cochrane"

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1906, Dec. 5 *Boston Evening Transcript*: "On Battleships"

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1927, July 3 *New York Times*: "Airplane Station in Mid-Ocean"

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Years Before Columbus"

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