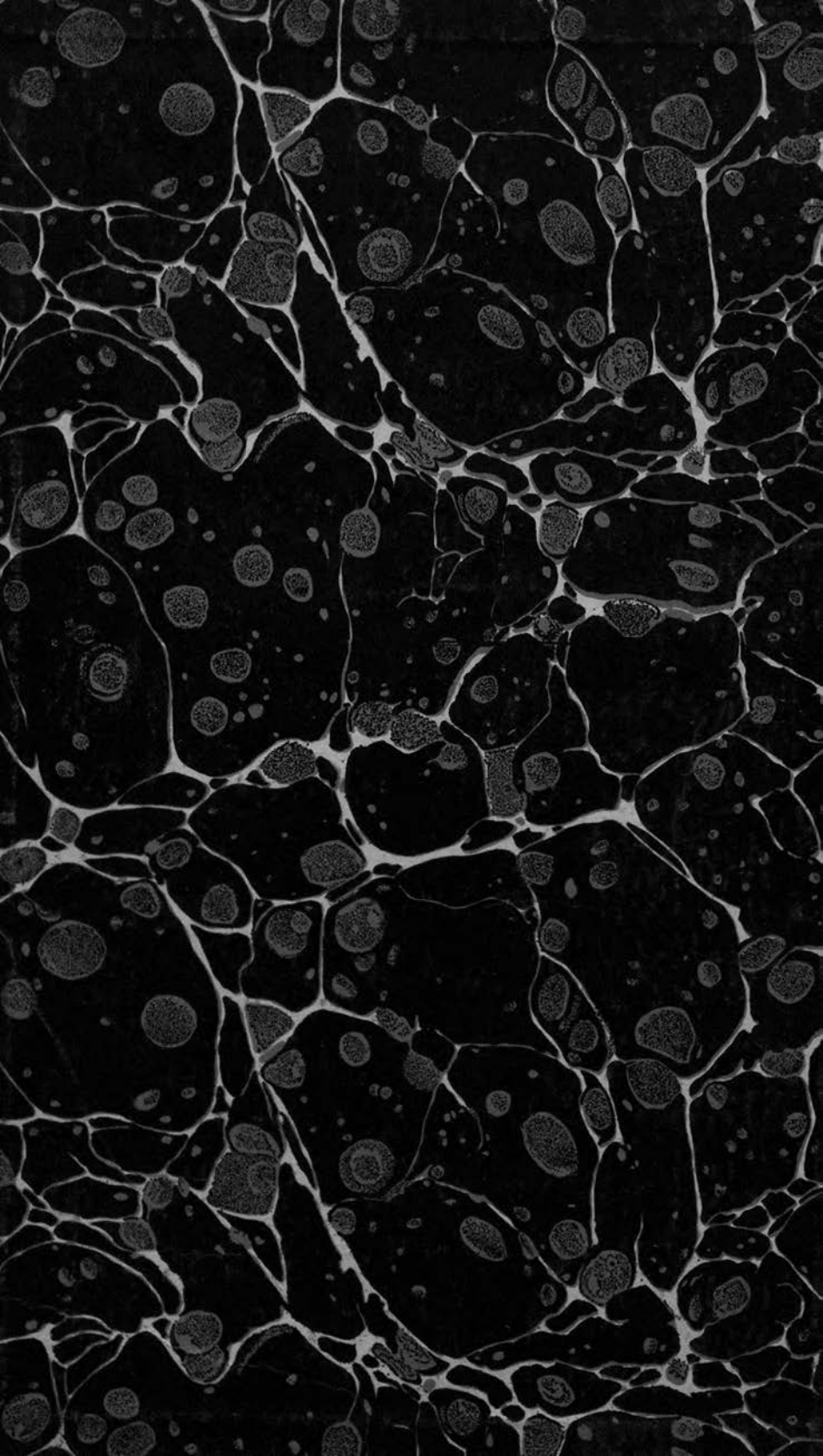
ANNUAL REPORT
OF THE
SECRETARY OF COMMERCE
—
1920



EIGHTH ANNUAL REPORT

OF THE

SECRETARY OF COMMERCE

1920

WASHINGTON
GOVERNMENT PRINTING OFFICE
1920

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CONTENTS.

EIGHTH ANNUAL REPORT

OF THE

SECRETARY OF COMMERCE.

DEPARTMENT OF COMMERCE,
OFFICE OF THE SECRETARY,
Washington, October 30, 1920.

To the PRESIDENT:

I have the honor to submit herewith, for transmission to Congress, in accordance with the provisions of the organic act, the eighth annual report of the Secretary of Commerce. Having assumed office December 16, 1919, this report covers a portion of the administration of my predecessor.

The Department as now constituted comprises the Bureaus of the Census, Foreign and Domestic Commerce, Standards, Fisheries, Lighthouses, Coast and Geodetic Survey, Navigation, and the Steamboat-Inspection Service. The Office of the Secretary is divided into five divisions, as follows: Chief Clerk and Superintendent, Disbursing Office, Appointment Division, Division of Publications, and Division of Supplies.

PERMANENT HOME FOR THE DEPARTMENT.

One of the greatest needs of the Department is a permanent home for the proper housing of its several bureaus and divisions. This matter has been repeatedly mentioned by my predecessor, who has covered the subject so thoroughly that I can only emphasize what has already been said. The Commerce Building, a rented structure, houses the divisions of the Office of the Secretary, three of the Department's bureaus, and portions of two others. The building is inadequate to the growing needs of the Department, and it is obvious that, with the overcrowding and scattering of activities, results so highly desirable can not be obtained. It is earnestly recommended that steps be taken at an early date looking to the erection of a building suitably adapted to the efficient administration of the Department.

SALARIES.

The annual estimates for the fiscal year 1922 have had my careful consideration. While some increases in salaries are asked, the estimates have been greatly reduced as originally submitted by the various services. No general increases have been asked in the regular salary grades, it being assumed that the Congress, through the adoption of the report of the Joint Commission on Reclassification of Salaries, or other measure, would provide the relief which is so urgently needed and deserved. The increases asked, for the most part, are confined to technical, scientific, and administrative positions, and represent approximately a 25 per cent increase over existing salaries. The increases submitted are actuated not by the present high cost of living, but in the belief that in normal times they more nearly represent compensation commensurate with the duties involved. The Department, to properly function, must have capable and trained employees. They can not be retained at salaries now paid by the Government. We are constantly losing the services of highly trained and valuable employees, not through a turnover in the personnel, but by actual separations, with but little hope of filling the positions thus vacated at existing salaries. This is also true, but to a less serious extent, in the clerical and mechanical grades. Government employees are, collectively, of a high order of intelligence, and the Government should adjust salaries to a basis that at least would be comparable with those paid in the business world. The Department is burdened with a number of clerical positions paying $900 per annum. This grade should be abolished and a higher entrance salary established, as it is almost impossible to obtain and retain competent employees at this salary.

An outline of the work of the Department, through its various bureaus, will be found under appropriate headings in the following pages.

APPROPRIATIONS AND EXPENDITURES.

The itemized statement of the disbursements from the contingent fund of the Department and the appropriation for "General expenses, Bureau of Standards," for the fiscal year ended June 30, 1920, required to be submitted to Congress by section 193 of the Revised Statutes of the United States; the itemized statement of expenditures under all appropriations for propagation of food fishes during the fiscal year ended June 30, 1920, required by the act of Congress approved March 3, 1887 (24 Stat., 523); the statement showing travel on official business by officers and employees (other than special agents, inspectors, and employees who, in the discharge of their regular duties, are required to travel constantly) from

Washington to points outside of the District of Columbia during the fiscal year ended June 30, 1920, as required by the act of Congress approved May 22, 1908 (35 Stat., 244); the statement showing typewriters, adding machines, etc., exchanged by this Department during the fiscal year ended June 30, 1920, as required by section 5 of the act of March 4, 1915 (38 Stat., 1161); and the statement in connection with the payment of increased compensation to employees of this Department during the first four months of the fiscal year ended June 30, 1921, as required by section 7 of the act of March 1, 1919 (40 Stat., 1268), will be transmitted to Congress in the usual form.

The table following shows the total amount of all appropriations for the various bureaus and services of the Department of Commerce for the fiscal year ended June 30, 1920:

Bureau.	Legislative act.	Sundry civil act.	Deficiency act.	Allotments by other departments.	Special act.	Total.
Office of the Secretary...	$314,550.00	.....	$2,007.55	.....	.....	$316,557.55
Bureau of Lighthouses..	65,430.00	$6,979,400.00	2,291,468.04	$97,000.00	$2,759.80	9,436,057.84
Bureau of the Census....	15,000,000.00	.....	2,550,000.00	.....	.....	17,550,000.00
Bureau of Foreign and Domestic Commerce..	910,510.00	.....	29.27	.....	.....	910,539.27
Steamboat-Inspection Service.....	995,890.00	5,550.00	24,505.91	.....	.....	1,025,945.91
Bureau of Navigation...	237,945.00	.....	49,145.54	.....	2,396.94	289,487.48
Bureau of Standards....	1,207,260.00	40,000.00	497,316.12	2,292.00	.....	1,746,868.12
Bureau of Fisheries.....	.....	1,206,190.00	190,332.79	.....	.....	1,396,522.79
Coast and Geodetic Survey.....	.....	1,614,280.00	312,300.40	35,500.00	.....	1,962,080.40
Total.....	18,731,585.00	9,845,420.00	5,917,105.62	134,792.00	5,156.74	34,634,059.36
Increase of compensation	2,218,030.80	.....	.....	.....	.....	2,218,030.80
Allotment for printing and binding.....	.....	300,000.00	.....	.....	.....	300,000.00
Grand total.....	20,949,615.80	10,145,420.00	5,917,105.62	134,792.00	5,156.74	37,152,090.16

The disbursements by the authorized disbursing officers of the Department during the fiscal year ended June 30, 1920, arranged according to items of appropriation, are as follows:

By Disbursing Clerk, Department of Commerce.

OFFICE OF THE SECRETARY.

Salaries, Office of the Secretary, 1919	$15,265.61
Salaries, Office of the Secretary, 1920	181,876.27
Contingent expenses, Department of Commerce, 1918	2,794.52
Contingent expenses, Department of Commerce, 1919	28,377.27
Contingent expenses, Department of Commerce, 1920	83,055.25
Rent, Department of Commerce, 1919	5,963.54

Rent, Department of Commerce, 1920	$61,957.62
National security and defense, electric railways investigation, 1919	9,619.71
National security and defense, Industrial Board, 1919	916.41
National security and defense, Industrial Cooperation Service, 1919	2,172.45
National security and defense, waste-reclamation work, 1919	1,383.37
Total	393,382.02

BUREAU OF FOREIGN AND DOMESTIC COMMERCE.

Commercial attachés, Department of Commerce, 1918	125.95
Commercial attachés, Department of Commerce, 1919	1,215.66
Commercial attachés, Department of Commerce, 1920	8,889.41
Promoting commerce, Department of Commerce, 1918	320.03
Promoting commerce, Department of Commerce, 1919	20,154.77
Promoting commerce, Department of Commerce, 1920	85,903.99
Promoting commerce, Far East, 1919	1,758.27
Promoting commerce, Far East, 1920	23,987.61
Promoting commerce, South and Central America, 1918	286.49
Promoting commerce, South and Central America, 1919	6,324.92
Promoting commerce, South and Central America, 1920	29,981.24
Salaries, Foreign and Domestic Commerce, 1919	11,783.45
Salaries, Foreign and Domestic Commerce, 1920	202,565.36
National security and defense, import and export statistics, 1918	27.19
National security and defense, import and export statistics, 1919	9,874.51
National security and defense, commodity experts, 1919	2,720.79
National security and defense, special statistical work, 1919	297.62
Total	406,217.26

BUREAU OF STANDARDS.

Armament of fortifications, commerce transfer	62,617.39
Radio laboratory	3,277.00
Color standardization, 1918	285.28
Color standardization, 1919	1,808.63
Color standardization, 1920	8,961.10
Equipping chemical laboratory building, 1917–18	11.93
Equipment, 1918	392.08
Equipment, 1919	12,871.31
Equipment, 1920	77,739.79
Determining physical constants, 1919	431.78
Determining physical constants, 1920	4,829.00
Gauge standardization, 1917–18	1,087.89
Gauge standardization, 1919	48,797.23
Gauge standardization, 1920	50,702.20
General expenses, 1918	386.20
General expenses, 1919	10,411.78
General expenses, 1920	24,349.89
High-potential investigation, 1918	408.16
High-potential investigation, 1919	2,964.48
Improvement and care of grounds, 1919	2,613.64
Improvement and care of grounds, 1920	6,631.18

High-temperature investigation, 1920	$7,160.79
Investigation of public-utility companies, 1918–19	12,766.86
Investigation of fire-resisting properties, 1918	9.85
Investigation of fire-resisting properties, 1919	3,535.66
Investigation of fire-resisting properties, 1920	21,382.92
Investigation of mine scales and cars, 1918–19	3,325.05
Investigation of mine scales and cars, 1920	14,723.81
Investigation of optical glass, 1919	12,011.87
Investigation of optical glass, 1920	55,056.86
Military research, 1917–18	2,220.52
Military research, 1918–19	72,767.04
Investigation of public-utility standards, 1918	171.11
Investigation of public-utility standards, 1919	8,291.49
Investigation of public-utility standards, 1920	105,690.04
Repairs, power plant, 1918	177.70
Aviation, Navy, commerce transfer, 1919	638.23
Investigation of railway materials, 1918	106.33
Investigation of railway materials, 1919	2,658.80
Investigation of railway materials, 1920	13,639.69
Investigation of clay products, 1919	3,443.23
Investigation of clay products, 1920	18,106.19
Standardizing mechanical appliances, 1918	9.65
Standardizing mechanical appliances, 1919	4,587.04
Standardizing mechanical appliances, 1920	35,758.73
Investigation of textiles, 1919	3,121.35
Investigation of textiles, 1920	14,620.80
Testing machines, 1918	408.95
Testing machines, 1919	2,740.81
Testing machines, 1920	29,791.08
Testing miscellaneous materials, 1918	2.00
Testing miscellaneous materials, 1919	4,977.63
Testing miscellaneous materials, 1920	27,380.57
Testing railroad scales, 1918	120.59
Testing railroad scales, 1919	3,962.18
Testing railroad scales, 1920	34,609.30
Renewal of storage batteries, 1919	6,410.59
Testing structural materials, 1918	10,229.89
Testing structural materials, 1919	15,360.08
Testing structural materials, 1920	122,418.58
Sugar standardization, 1919	4,329.73
Sugar standardization, 1920	17,242.37
Radio research, 1919	1,425.44
Radio research, 1920	29,646.05
Salaries, 1919	32,458.39
Salaries, 1920	443,243.84
Standard materials, 1919	481.83
Standard materials, 1920	3,577.22
Equipping laboratory, 1919–20	87,209.29
Industrial research, 1919–20	151,698.46
Industrial research, 1920	104,608.49
Metallurgical research, 1920	25,145.68
Sound investigation, 1920	5,378.20
Testing Government materials, 1920	60,238.76
Industrial safety standards, 1920	19,173.17

Platinum and rare metals, 1920	$13,385.91
Retaining wall, 1920	15,864.97
Standardization of equipment, 1920	19,335.30
National security and defense, industrial laboratory, 1918	1,065.58
National security and defense, industrial laboratory, 1919	38,779.24
National security and defense, metallurgical work, 1918	1,678.75
National security and defense, new building, 1918	877.09
National security and defense, production of fabrics, 1918	9,394.42
National security and defense, production of optical glass, 1918	72.93
National security and defense, Roberts by-product coke oven, 1918	13,337.38
National security and defense, Roberts by-product coke oven, 1919	14,759.97
National security and defense, thermite investigation, 1918	3.60
National security and defense, thermite investigation, 1919	280.48
National security and defense, completing laboratory, 1919	59,702.28
National security and defense, military researches, 1919	34,090.01
Total	2,204,456.63

STEAMBOAT-INSPECTION SERVICE.

Contingent expenses, Steamboat-Inspection Service, 1918	409.83
Contingent expenses, Steamboat-Inspection Service, 1919	30,301.91
Contingent expenses, Steamboat-Inspection Service, 1920	126,318.60
Clerk hire, Steamboat-Inspection Service, 1919	9,748.64
Clerk hire, Steamboat-Inspection Service, 1920	103,528.81
Salaries, office of Supervising Inspector General, 1919	2,036.70
Salaries, office of Supervising Inspector General, 1920	22,034.14
Salaries, Steamboat-Inspection Service, 1919	52,398.39
Salaries, Steamboat-Inspection Service, 1920	602,868.11
Total	949,645.13

BUREAU OF NAVIGATION.

Admeasurement of vessels, 1919	638.90
Admeasurement of vessels, 1920	2,466.28
Clerk hire, Shipping Service, 1919	4,188.15
Clerk hire, Shipping Service, 1920	51,204.17
Contingent expenses, Shipping Service, 1918	1.57
Contingent expenses, Shipping Service, 1919	2,127.56
Contingent expenses, Shipping Service, 1920	5,933.84
Enforcement of navigation laws, 1919	1,921.37
Enforcement of navigation laws, 1920	39,689.83
Enforcement of wireless-communication laws, 1918	27.05
Enforcement of wireless-communication laws, 1919	5,237.50
Enforcement of wireless-communication laws, 1920	57,989.38
Preventing overcrowding of passenger vessels, 1918	2.50
Preventing overcrowding of passenger vessels, 1919	2,266.68
Preventing overcrowding of passenger vessels, 1920	14,970.07
Salaries, Bureau of Navigation, 1919	3,107.07
Salaries, Bureau of Navigation, 1920	37,338.92
Salaries, Shipping Service, 1919	2,492.36
Salaries, Shipping Service, 1920	26,821.14
Total	258,424.34

BUREAU OF FISHERIES.

Fish hatchery, Cape Vincent, N. Y., 1918	$89.36
Fish hatchery, Cape Vincent, N. Y., 1920	2,556.76
Fish hatchery, Edenton, N. C., 1918	194.15
Fish hatchery, Puget Sound, Wash	496.40
Fish hatchery, Bozeman, Mont	1,552.64
Fish hatchery, Cold Spring, Ga	502.35
Fish hatchery, San Marcos, Tex	4,000.00
Fish hatchery, South Carolina	801.67
Fish hatchery, St. Johnsbury, Vt	3,406.13
Fish hatchery, Washington	13,687.01
Fish hatchery, Wytheville, Va., 1920	2,516.46
Trout hatchery, Berkshire, Mass	270.13
Investigating damages to fisheries	461.58
Marine biological station, Florida	11,153.05
Power lighter, fur-seal islands, Alaska	27,450.52
Distribution cars, 1920	55,000.00
Developing aquatic sources of leather, 1917–18	1,174.09
Developing aquatic sources of leather, 1919	146.79
Developing aquatic sources of leather, 1920	136.07
Miscellaneous expenses, 1918	5,018.30
Miscellaneous expenses, 1919	102,054.90
Miscellaneous expenses, 1920	477,253.32
Protecting seal and salmon fisheries of Alaska, 1918	102.82
Protecting seal and salmon fisheries of Alaska, 1919	40,808.70
Protecting seal and salmon fisheries of Alaska, 1920	121,575.97
Salaries, 1919	31,269.38
Salaries, 1920	373,304.92
Pay, officers and crew of vessel, Alaska fisheries service, 1919	265.06
Pay, officers and crew of vessel, Alaska fisheries service, 1920	12,265.59
Biological station, Mississippi Valley	63,199.11
National security and defense, food-fish supply, 1918	156.86
National security and defense, food-fish supply, 1919	3,595.96
National security and defense, seal-oil plant, 1918	10.50
National security and defense, demonstration plant, 1919	31,650.56
National security and defense, rescuing food fish, 1918	1.89
Total	1,388,129.00

BUREAU OF THE CENSUS.

Collecting statistics, 1918	111.90
Collecting statistics, 1919	42,526.62
Tabulating machines, 1918	11.74
Tabulating machines, 1919	8,380.94
Salaries, 1919	58,961.77
Punching machines, 1919	38,527.75
National security and defense, uniform nomenclature, 1919	1,102.39
National security and defense, special statistical work, 1919	11,585.60
Total	161,208.71

BUREAU OF LIGHTHOUSES.

Aids to navigation, Alaska	$1,799.38
Aids to navigation, Chesapeake Bay, Md. and Va	84.57
Aids to navigation, Hudson River, N. Y	75.28
Aids to navigation, Delaware River, Pa. and Del	20,843.70
Aids to navigation, Fighting Island Channel, Detroit River, Mich	39.45
Aids to navigation, Pearl Harbor, Hawaii	61.30
Aids to navigation, St. Marys River, Mich	4,864.13
Aids to navigation, Wash. and Oreg	2.78
Aids to navigation, Conneaut Harbor, Ohio	30.96
Aids to navigation, East River, N. Y	20.79
Aids to navigation, Huron Harbor, Ohio	6.03
Aids to navigation, Mississippi River, La	41.70
Aids to navigation, Guantanamo Bay, Cuba	240.00
Aids to navigation, St. Johns River, Fla	21.98
Aids to navigation, Keeweenaw Waterway, Mich	8.74
Fifth lighthouse district gas buoys	895.69
Chicago Harbor Light Station, Ill	35.44
Navassa Island Light Station, West Indies	2.21
Point Borinquen Light Station, P. R	10,965.13
Thimble Shoal Light Station, Va	2.44
Point Jacinto Light Station, P. R	14.49
Joe Flogger Shoal Light Station, Delaware River	332.47
Kellett Bluff Light Station, Wash	2.25
Ambrose Channel, N. Y., lighted buoys	46.90
Light vessels for general lake service	88,456.80
Light vessels for general service	11,078.91
Vessels for Lighthouse Service	324.10
Lighthouse depot, sixteenth lighthouse district	3,077.26
Lighthouse depot, Detroit, Mich	2,064.00
Lighting Norfolk Harbor	34.72
Cape Charles Light Vessel, Va	99.62
Diamond Shoal Light Vessel, N. C	324.12
Tender for third lighthouse district	99.64
General expenses, Lighthouse Service, 1918	3,151.20
General expenses, Lighthouse Service, 1919	58,392.41
General expenses, Lighthouse Service, 1920	35,335.74
Salaries, Bureau of Lighthouses, 1919	4,947.75
Salaries, Bureau of Lighthouses, 1920	56,921.36
Salaries, Lighthouse Service, 1919	450.00
Salaries, Lighthouse Service, 1920	5,996.67
Salaries, keepers of lighthouses, 1918	58.00
Salaries, keepers of lighthouses, 1919	62.83
Salaries, keepers of lighthouses, 1920	2,595.33
Salaries, lighthouse vessels, 1919	7.97
Salaries, lighthouse vessels, 1920	1,681.33
Light-keepers' dwellings	6.96
Nantucket Harbor Fog-Signal Station, Mass	7.79
Dog Island Light, Me	6.65
Repairing and rebuilding aids to navigation, Atlantic coast	323.20
Repairing and rebuilding aids to navigation, Gulf of Mexico	327.22
Radio installations on lighthouse tenders	5,400.00

National security and defense, aids to navigation, Caribbean Sea, 1919	$394.44
National security and defense, lighthouse depot, Tompkinsville, N. Y., 1919	36,351.70
Total	358,415.53

MISCELLANEOUS.

Increase of compensation, Department of Commerce, 1918	11.80
Increase of compensation, Department of Commerce, 1919	22,565.28
Increase of compensation, Department of Commerce, 1920	481,682.01
Total	504,259.09
Grand total	6,624,137.71

By disbursing officers, Lighthouse Service.

Salaries, keepers of lighthouses, 1919	61,913.00
Salaries, keepers of lighthouses, 1920	1,239,067.51
Salaries, Lighthouse Service, 1919	3,985.14
Salaries, Lighthouse Service, 1920	372,224.62
Salaries, lighthouse vessels, 1918	46.50
Salaries, lighthouse vessels, 1919	81,384.35
Salaries, lighthouse vessels, 1920	1,679,361.59
Retired pay, Lighthouse Service, 1919	458.34
Retired pay, Lighthouse Service, 1920	50,963.75
Increase of compensation, Department of Commerce, 1918	4.65
Increase of compensation, Department of Commerce, 1919	14,638.90
Increase of compensation, Department of Commerce, 1920	643,977.60
General expenses, Lighthouse Service, 1918	70,645.76
General expenses, Lighthouse Service, 1919	918,741.99
General expenses, Lighthouse Service, 1920	3,034,122.55
Aids to navigation, Washington and Oregon	7,515.56
Aids to navigation, Pearl Harbor, Hawaii	70.40
Aids to navigation, Hudson River, N. Y	703.90
Aids to navigation, East River, N. Y	7,993.92
Aids to navigation, Delaware River, Pa. and Del	1,429.92
Aids to navigation, Cape Charles City, Va	9,122.69
Aids to navigation, Chesapeake Bay, Md. and Va	3,710.10
Aids to navigation, St. Johns River, Fla	4,421.66
Aids to navigation, Florida Reefs, Fla	35.56
Aids to navigation, Mississippi River, La	17,994.92
Aids to navigation, Conneaut Harbor, Ohio	20,267.88
Aids to navigation, Toledo Harbor, Ohio	376.08
Aids to navigation, Huron Harbor, Ohio	564.85
Aids to navigation, Fairport Harbor, Ohio	10,589.52
Aids to navigation, Fighting Island Channel, Detroit River, Mich	3,359.32
Aids to navigation, Keweenaw Waterway, Mich	30,756.01
Aids to navigation, St. Marys River, Mich	22,581.05
Aids to navigation, Indiana Harbor, Ind	2,245.40
Aids to navigation, Alaska	32,766.78
Aids to navigation, Coquille River, Oreg	4.00
Aids to navigation, Guantanamo Bay, Cuba	11,366.13

Repairing and rebuilding aids to navigation, Atlantic coast	$149,238.15
Repairing and rebuilding aids to navigation, seventh and eighth lighthouse districts	2,672.25
Repairing and rebuilding aids to navigation, Gulf of Mexico	51,072.11
Great Salt Pond Light Station, R. I	18,686.93
Execution Rocks, Light Station, N. Y	596.90
Joe Flogger Shoal Light Station, Delaware River	21,050.81
Thimble Shoal Light Station, Va	1,507.00
Aransas Pass Light Station, Tex	9,490.00
Sand Island Light Station, Ala	9.42
Sand Hills Light Station, Mich	838.52
White Shoal Light Station, Mich	351.83
Chicago Harbor Light Station, Ill	3,894.22
Manitowoc Breakwater Light Station, Wis	6,256.43
Kellett Bluff Light Station, Wash	886.25
Point Borinquen Light Station, P. R	32,692.00
Point Jiguero Light Station, P. R	221.16
Nantucket Harbor Fog Signal, Mass	2,218.02
Ambrose Channel, N. J., lighted buoys	25,696.90
Fifth lighthouse district gas buoys	47,058.44
Southwest Pass Light Vessel, Mississippi River	44.00
Detroit River Lights, Mich	14.40
Woods Hole Lighthouse Depot, Mass	554.14
Depot for second lighthouse district	13,022.07
Staten Island Lighthouse Depot, N. Y	34,186.95
Detroit Lighthouse Depot, Mich	31,360.66
Depot for sixteenth lighthouse district	44,488.06
Tender and barge, eighth lighthouse district	10.50
Riprap protection for light station, third lighthouse district	60.72
Light vessels for general service	6,994.84
Light vessels for general lake service	1,830.00
Vessels for Lighthouse Service	628.84
Light-keepers' dwellings	2,846.24
National security and defense, lighthouse depot, Tompkinsville, N. Y., 1919	53,384.14
National security and defense, aids to navigation, Caribbean Sea, 1919	8,139.87
Total	8,931,414.67

By special disbursing agent, Coast and Geodetic Survey.

Salaries, Coast and Geodetic Survey, 1919	15,130.98
Salaries, Coast and Geodetic Survey, 1920	443,595.19
Party expenses, Coast and Geodetic Survey	367.13
Party expenses, Coast and Geodetic Survey, 1918	153.91
Party expenses, Coast and Geodetic Survey, 1919	71,359.97
Party expenses, Coast and Geodetic Survey, 1920	450,095.67
Repairs of vessels, Coast and Geodetic Survey, 1919	9,712.20
Repairs of vessels, Coast and Geodetic Survey, 1920	42,898.52
General expenses, Coast and Geodetic Survey, 1918	4,013.40
General expenses, Coast and Geodetic Survey, 1919	12,110.85
General expenses, Coast and Geodetic Survey, 1920	81,007.44
Pay, etc., of officers and men, vessels, Coast and Geodetic Survey, 1919	50,847.09

Pay, etc., of officers and men, vessels, Coast and Geodetic Survey, 1920	$392,442.87
General expenses, Coast and Geodetic Survey, 1919–20	12,517.22
National security and defense, new building, 1918	12,902.14
National security and defense, new building, 1919	614.25
National security and defense, building equipment, 1919	19,150.52
Motor-driven vessel and new launches, Coast and Geodetic Survey, 1919	18,707.29
Increase of compensation, Department of Commerce, 1919	6,248.07
Increase of compensation, Department of Commerce, 1920	140,692.21
Total	1,784,566.92

By special disbursing agents, Bureau of Fisheries.

Marine biological station, Florida	263.43
Miscellaneous expenses, Bureau of Fisheries, 1920	1,635.43
Protecting seal and salmon fisheries of Alaska, 1920	1,875.00
Total	3,773.86

By disbursing clerk, Bureau of the Census.

Expenses of the Fourteenth Census, 1920–1922	12,140,152.52
Increase of compensation, Department of Commerce, 1920	620,621.95
Total	12,760,774.47

By special disbursing agents, Bureau of the Census.

Expenses of the Fourteenth Census, 1920–1922	186,571.64

By special disbursing agents, Bureau of Standards.

Salaries, Bureau of Standards, 1920	631.94
Equipment, Bureau of Standards, 1920	472.43
Gauge standardization, 1920	367.33
General expenses, 1920	580.22
Industrial research, 1919–20	769.24
Industrial research, 1920	806.73
Investigation of public-utility standards, 1920	1,435.21
Metallurgical research, 1920	537.75
Radio research, 1920	586.79
Total	6,187.64

By commercial agents of the Department investigating trade conditions abroad.

Promoting commerce, Department of Commerce, 1920	176,367.78
Promoting commerce, South and Central America, 1920	39,639.24
Commercial attachés, Department of Commerce, 1920	105,426.12
Promoting commerce, Far East, 1920	58,480.40
Total	379,913.54

Warrants drawn on the Treasurer of the United States to satisfy accounts settled by the Auditor for the State and Other Departments

during the fiscal year ended June 30, 1920, classified according to items of appropriation:

Office of the Secretary:	
Contingent expenses, Department of Commerce, 1918	$25.77
Contingent expenses, Department of Commerce, 1919	4,324.71
Contingent expenses, Department of Commerce, 1920	6,863.79
National security and defense, Swedish iron ore, 1918	3,219,648.32
National security and defense, Industrial Board, 1919	2,011.49
National security and defense, Industrial Cooperation Service, 1919	7,476.59
National security and defense, waste-reclamation work, 1919	467.84
Certified claims—Contingent expenses, Department of Commerce, 1917	6.95
Total	3,240,825.46
Bureau of Foreign and Domestic Commerce:	
Commercial attachés, 1918	2.76
Commercial attachés, 1919	35.74
Commercial attachés, 1920	61.84
Promoting commerce, Department of Commerce, 1918	117.00
Promoting commerce, Department of Commerce, 1919	400.23
Promoting commerce, Department of Commerce, 1920	217.22
Promoting commerce, Far East, 1920	89.81
Promoting commerce, South and Central America, 1918	18.36
Promoting commerce, South and Central America, 1919	316.23
Promoting commerce, South and Central America, 1920	22.40
National security and defense, import and export statistics, 1919	13,272.02
National security and defense, commodity experts, 1919	90.00
Certified claims—	
Commercial attachés, 1917	15.00
Promoting commerce, Department of Commerce, 1917	1,264.02
Promoting commerce, South and Central America, 1917	.25
Total	15,922.88
Bureau of Standards:	
Armament of fortifications, commerce transfer	1,193.28
Color standardization, 1919	3.45
Equipment, 1919	600.72
Equipment, 1920	152.18
Gauge standardization, 1917–18	62.43
Gauge standardization, 1919	3,297.10
Gauge standardization, 1920	36.80
General expenses, 1918	9.75
General expenses, 1919	12,664.58
General expenses, 1920	3,624.03
Investigating public-utility standards, 1919	25.00
Investigation public-utility standards, 1920	143.33
Investigation of railway materials, 1919	24.60
Military research, 1917–18	1,997.99

Bureau of Standards—Continued.	
Military research, 1918–19	$4,393.60
Radio research, 1920	111.60
Standardizing mechanical appliances, 1920	156.01
Testing machines, 1919	41.85
Testing machines, 1920	13.80
Testing miscellaneous materials, 1919	3.82
Testing railroad scales, 1919	42.20
Testing structural materials, 1918	299.32
Testing structural materials, 1919	415.14
Testing structural materials, 1920	492.98
Investigation of optical glass, 1919	89.12
Investigation of optical glass, 1920	16.56
Investigation of textiles, 1920	9.16
Equipping laboratory, 1919–20	2,520.15
Industrial safety standards, 1920	132.67
Metallurgical research, 1920	149.74
Testing Government materials, 1920	267.75
National security and defense, industrial laboratory, 1918	1,349.08
National security and defense, metallurgical work, 1918	130.00
National security and defense, production of optical glass, 1918	119.70
National security and defense, completing laboratory, 1919	10.82
National security and defense, military researches, 1919	235.40
Certified claims—	
Color standardization, 1917	98.56
Determining physical constants, 1917	49.87
Equipment, 1916	147.20
Equipment, 1917	136.68
Equipping chemical laboratory building, 1916–17	48.48
General expenses, 1917	2.40
Investigation of fire-resisting properties, 1916	15.48
Investigation of railway materials, 1916	11.40
Radio research, 1917	6.50
Standardizing mechanical appliances, 1917	17.72
Testing machines, 1917	29.68
Testing railroad scales, 1917	38.24
Testing structural materials, 1917	218.61
Total	35,656.53
Bureau of Navigation:	
Refunding penalties or charges erroneously exacted	2,379.38
Admeasurement of vessels, 1919	2.87
Contingent expenses, Shipping Service, 1919	6.92
Enforcement of navigation laws, 1920	85.50
Enforcement of wireless-communication laws, 1919	276.36
Certified claims—Enforcement of wireless-communication laws, 1917	6.59
Total	2,757.62

Steamboat-Inspection Service:	
Contingent expenses, 1918	$27.51
Contingent expenses, 1919	662.02
Contingent expenses, 1920	147.77
Certified claims—	
Contingent expenses, 1916	.76
Contingent expenses, 1917	66.63
Total	904.69
Bureau of Fisheries:	
Building and improvements, fur-seal islands, Alaska	156.98
Fish hatchery, Wytheville, Va., 1920	5,959.78
Investigating damages to fisheries	17.97
Marine biological station, Florida	168.64
Developing aquatic sources of leather, 1919	11.52
Miscellaneous expenses, 1918	157.93
Miscellaneous expenses, 1919	2,412.46
Miscellaneous expenses, 1920	956.79
Protecting seal and salmon fisheries of Alaska, 1918	63.40
Protecting seal and salmon fisheries of Alaska, 1919	158.49
Protecting seal and salmon fisheries of Alaska, 1920	27.85
Salaries, 1919	45.00
Repairs to steamer *Fish Hawk*, 1918	58.05
National security and defense, demonstration plant, 1919	318.93
National security and defense, food-fish supply, 1919	4.56
Certified claims—	
Miscellaneous expenses, 1905	.88
Miscellaneous expenses, 1908	.70
Miscellaneous expenses, 1909	4.11
Miscellaneous expenses, 1910	2.82
Miscellaneous expenses, 1911	1.74
Miscellaneous expenses, 1912	4.97
Miscellaneous expenses, 1916	.31
Miscellaneous expenses, 1917	27.13
Total	10,561.01
Bureau of the Census:	
Expense of the Fourteenth Census, 1920–1922	388,835.30
Relief of Alice V. Houghton for injuries	450.00
National security and defense, special statistical work, 1919	6,850.17
National security and defense, uniform nomenclature, 1919	2,604.44
Total	398,739.91
Coast and Geodetic Survey:	
Two new vessels	25.16
General expenses, 1919	944.24
General expenses, 1920	2,855.67
General expenses, 1919–20	1,323.59
Party expenses, 1918	1,978.98
Party expenses, 1919	23,737.12
Party expenses, 1920	354.53
Pay, etc., officers and men, vessels, 1919	49.85
Pay, etc., officers and men, vessels, 1920	40.63

Coast and Geodetic Survey—Continued.	
Repairs of vessels, 1918	$1,698.71
Repairs of vessels, 1919	1,773.03
Repairs of vessels, 1920	80.57
National security and defense, new building, 1918	1,078.00
National security and defense, new building, 1919	5.50
National security and defense, building equipment, 1919	130.22
Certified claims—	
Party expenses, 1917	629.36
Repairs of vessels, 1917	13.71
Total	36,718.87
Bureau of Lighthouses:	
Aids to navigation, Alaska	1,449.15
Aids to navigation, Atchafalaya Entrance, La	7,086.46
Aids to navigation, Pearl Harbor, Hawaii	126.37
Aids to navigation, Washington and Oregon	128.98
Light station, Kellett Bluff, Wash	21.01
Lighthouse depot, sixteenth lighthouse district	149.92
Radio installations on lighthouse tenders	15,634.48
Reimbursement to R. C. Hart for losses	300.00
Repairing and rebuilding aids to navigation, Atlantic coast	375.86
Repairing and rebuilding aids to navigation, Gulf of Mexico	4,021.17
General expenses, 1918	22,205.85
General expenses, 1919	267,742.48
General expenses, 1920	28,892.27
Salaries, keepers of lighthouses, 1918	177.00
Salaries, lighthouse vessels, 1918	397.59
Salaries, lighthouse vessels, 1919	7,019.17
Salaries, lighthouse vessels, 1920	1,469.97
National security and defense, aids to navigation, Caribbean Sea, 1919	619.92
Certified claims—	
General expenses, 1915	.97
General expenses, 1916	11,707.18
General expenses, 1917	5,362.95
Salaries, Lighthouse Service, 1917	4.40
Total	374,893.15
Miscellaneous:	
Increase of compensation, Department of Commerce, 1918	23.45
Increase of compensation, Department of Commerce, 1919	3.00
Judgments, Court of Claims, Department of Commerce	2,909.80
Total	2,936.25
Grand total	4,119,916.37

The following statement shows the expenditures during the fiscal year ended June 30, 1920, on account of all appropriations under the control of the Department, giving the total amounts disbursed by the various disbursing officers of the Department and miscellaneous receipts for the same period.

EXPENDITURES.

By the Disbursing Clerk, Department of Commerce, on account of salaries and expenses of the Office of the Secretary of Commerce, the Bureaus of Foreign and Domestic Commerce, Navigation, Standards, Fisheries, Census, and Lighthouses, the Office of the Supervising Inspector General, Steamboat-Inspection Service, salaries and expenses of the Steamboat-Inspection Service at large, and public works of the Lighthouse and Fisheries Services (shown in detail in the first of the foregoing tables of disbursements)	$6,624,137.71
By the authorized disbursing officers of the Lighthouse Service	8,931,414.67
By the special disbursing agent, Coast and Geodetic Survey	1,784,566.92
By the special disbursing agents, Bureau of Fisheries	3,773.86
By the commercial agents of the Department investigating trade conditions abroad, as special disbursing agents	379,913.54
By the disbursing clerk, Bureau of the Census	12,760,774.47
By the special disbursing agents, Bureau of the Census	186,571.64
By the special disbursing agents, Bureau of Standards	6,187.64
By warrants drawn on the Treasurer of the United States to satisfy accounts settled by the Auditor for the State and Other Departments	4,119,916.37
Printing and binding	299,995.97
Total	35,097,252.79

MISCELLANEOUS RECEIPTS.

Coast and Geodetic Survey: Sale of charts, publications, old property, etc	48,578.17
Bureau of the Census: Sale of publications, etc	258.00
Bureau of Fisheries:	
Sale of 9,086 sealskins	635,223.66
Sale of fox and other skins	126 193.72
Sale of seal bones	779.04
Sale of seal oil	3,628.90
Sale of fertilizer from Pribilof Islands	771.30
Sale of old property, etc	36,499.53
Bureau of Navigation:	
Tonnage tax	1,707,934.44
Navigation fees	176,087.39
Navigation fines	112,955.35
Court costs	440.61
Deceased passenger fines	870.00
Sale of old property, etc	25.25
Bureau of Standards: Test fees	79,662.55
Steamboat-Inspection Service: Sale of old property, etc	90.38
Bureau of Lighthouses: Sale of old property, rentals, etc	20 897.34
Office of the Secretary: Sale of old property, etc	254.38
Bureau of Foreign and Domestic Commerce: Sale of old property, etc	47.35
Total	2,951,196.46

The following unexpended balances of appropriations were turned into the surplus fund June 30, 1920, in accordance with the act of June 20, 1874 (18 Stat., 110–111):

Office of the Secretary:	
Salaries, Office of the Secretary of Commerce, 1918	$5,400.77
Increase of compensation, Department of Commerce, 1918	49.70
Increase of compensation, Department of Commerce, 1919	4,893.94
Rent, Department of Commerce, 1918	250.00
Watch and medals for officers and crew of American steamer *Kroonland*	236.12
Bureau of the Census:	
Salaries, Bureau of the Census, 1918	24,365.29
Collecting statistics, Bureau of the Census, 1917	4.96
Collecting statistics, Bureau of the Census, 1918	176,828.12
Tabulating machines, Bureau of the Census, 1918	9,054.24
Bureau of Foreign and Domestic Commerce:	
Salaries, Bureau of Foreign and Domestic Commerce, 1918	11,603.23
Commercial attachés, Department of Commerce, 1917	221.60
Commercial attachés, Department of Commerce, 1918	2,645.23
Promoting commerce, Department of Commerce, 1917	53.59
Promoting commerce, Department of Commerce, 1918	920.53
Promoting commerce, South and Central America, 1917	184.37
Promoting commerce, South and Central America, 1918	5,638.94
Steamboat-Inspection Service:	
Salaries, office of Supervising Inspector General, Steamboat-Inspection Service, 1918	147.78
Salaries, Steamboat-Inspection Service, 1918	18,688.07
Clerk hire, Steamboat-Inspection Service, 1918	610.16
Contingent expenses, Steamboat-Inspection Service, 1917	993.16
Contingent expenses, Steamboat-Inspection Service, 1918	4,795.12
Steamboat-Inspection Service, Tampa, Fla., 1918	1,452.56
Bureau of Navigation:	
Salaries, Bureau of Navigation, 1918	917.53
Salaries, Shipping Service, 1918	828.92
Clerk hire, Shipping Service, 1918	695.60
Contingent expenses, Shipping Service, 1917	4.14
Contingent expenses, Shipping Service, 1918	77.67
Admeasurement of vessels, 1918	.57
Preventing overcrowding of passenger vessels, 1918	57.70
Enforcement of navigation laws, 1917	.35
Enforcement of navigation laws, 1918	132.88
Enforcement of wireless-communication laws, 1918	15.54
Bureau of Standards:	
Salaries, Bureau of Standards, 1918	32,280.97
Equipment, Bureau of Standards, 1917	.18
Equipment, Bureau of Standards, 1918	814.84
General expenses, Bureau of Standards, 1918	734.99
Improvement and care of grounds, Bureau of Standards, 1918	53.60
Additional land, Bureau of Standards, 1918	25,000.00
Color standardization, Bureau of Standards, 1918	333.42
Determining physical constants, Bureau of Standards, 1918	5.69
Equipping chemical laboratory building, Bureau of Standards, 1916–17	23.45

Bureau of Standards—Continued.	
Equipping chemical laboratory building, Bureau of Standards, 1917–18	$290.58
Gauge standardization, etc., Bureau of Standards, 1917–18	517.59
Investigation of clay products, Bureau of Standards, 1918	5.47
Investigation of fire-resisting properties, Bureau of Standards, 1918	140.53
High-potential investigations, Bureau of Standards, 1918	343.33
Investigation of optical glass, Bureau of Standards, 1918	214.92
Investigation of public-utility standards, Bureau of Standards, 1918	50.26
Investigation of railway materials, Bureau of Standards, 1917	37.17
Investigation of railway materials, Bureau of Standards, 1918	391.01
Military research, Bureau of Standards, 1917–18	6,986.93
Laboratory, Bureau of Standards	107.08
Chemical laboratory, Bureau of Standards	2,451.17
Radio research, Bureau of Standards, 1918	30.96
Refrigeration constants, Bureau of Standards, 1917	8.07
Repairs, power p'ant, Bureau of Standards, 1918	255.43
Standardizing mechanical appliances, Bureau of Standards, 1918	427.17
Testing machines, Bureau of Standards, 1918	422.79
Testing miscellaneous materials, Bureau of Standards, 1918	780.17
Testing railroad scales, etc., Bureau of Standards, 1917	2.30
Testing railroad scales, etc., Bureau of Standards, 1918	128.75
Testing structural materials, Bureau of Standards, 1917	2.75
Testing structural materials, Bureau of Standards, 1918	1,211.66
Workshop and storehouse, Bureau of Standards	35.06
Coast and Geodetic Survey:	
Salaries, Coast and Geodetic Survey, 1918	97,554.70
Additional employees, Coast and Geodetic Survey, 1918	1,277.28
Party expenses, Coast and Geodetic Survey, 1918	135,110.81
General expenses, Coast and Geodetic Survey, 1918	390.59
Charts, Coast and Geodetic Survey, 1917–18	583.74
Pay, etc., of officers and men, vessels, Coast and Geodetic Survey, 1918	137,399.52
Repairs of vessels, Coast and Geodetic Survey, 1918	21,376.53
Construction of vessel, Coast and Geodetic Survey	50,000.00
Bureau of Lighthouses:	
Salaries, Bureau of Lighthouses, 1918	5,397.98
General expenses, Lighthouse Service, 1916	13.16
General expenses, Lighthouse Service, 1917	180.89
General expenses, Lighthouse Service, 1918	186,466.20
Salaries, keepers of lighthouses, 1918	9,858.88
Salaries, lighthouse vessels, 1917	109.67
Salaries, lighthouse vessels, 1918	88,274.88
Salaries, Lighthouse Service, 1918	21,878.15
Aids to navigation, Cape Charles City, Va	153.31
Aransas Pass Light Station, Tex	59.05
Superior Pierhead Range Lights, Wis	70.10
Tender for first lighthouse district	4,301.61
Tender for engineer, sixth lighthouse district	786.17
Lighthouse tender for general service	1,468.17

Bureau of Fisheries:	
Salaries, Bureau of Fisheries, 1918	$28,311.50
Miscellaneous expenses, Bureau of Fisheries, 1917	330.94
Lobster-rearing plant, Bureau of Fisheries	4,960.15
Pay, officers and crew of vessel, Alaska fisheries service, 1918	2,412.41
Protecting seal and salmon fisheries of Alaska, 1918	34.27
Fish hatchery, Cape Vincent, N. Y., 1918	989.70
Fish hatchery, Puget Sound, Wash	15.73
Fish hatchery, South Carolina	5.99
Fish hatchery, Woods Hole, Mass., 1918	3,000.00
Power lighter, fur-seal islands, Alaska	11.17
Repairs to steamer *Fish Hawk*, 1918	723.36
Total	1,149,363.28

In the last eight years the Department of Commerce has turned back unused into the Treasury the following amounts:

June 30, 1913	$618,970.01	June 30, 1918	$149,009.51
June 30, 1914	347,162.48	June 30, 1919	476,045.10
June 30, 1915	247,482.22	June 30, 1920	1,149,363.28
June 30, 1916	227,941.92		
June 30, 1917	177,995.27	Total	3,393,969.79

ESTIMATES FOR FISCAL YEAR ENDING JUNE 30, 1922.

The estimates of appropriations required for the fiscal year 1922 amount in the aggregate to $30,383,481, and compared with the appropriations already made for the fiscal year 1921, amounting to $20,261,769, show an increase of $10,121,712, a detailed statement of which appears in the following table:

COMPARISON OF THE ITEMS OF ESTIMATES FOR THE DEPARTMENT OF COMMERCE SUBMITTED FOR THE FISCAL YEAR 1922 WITH THE APPROPRIATIONS MADE BY CONGRESS FOR THE FISCAL YEAR 1921.

	Estimates, 1922.	Appropriations, 1921.	Increase.	Decrease.
OFFICE OF THE SECRETARY.				
Salaries	$216,550	$196,050	$20,500	.....
Contingent expenses	60,000	50,000	10,000	.....
Rent	68,500	68,500	.....	.....
Total	345,050	314,550	30,500	.....
LIGHTHOUSE SERVICE.				
Salaries, Bureau of Lighthouses	89,540	67,290	22,250	.....
General expenses	5,100,000	4,200,000	900,000	.....
Salaries of keepers	1,590,000	1,300,000	290,000	.....
Salaries, light vessels	2,175,000	1,800,000	375,000	.....
Salaries, Lighthouse Service	500,000	400,000	100,000	.....
Retired pay, Lighthouse Service	100,000	70,000	30,000	.....

COMPARISON OF THE ITEMS OF ESTIMATES FOR THE DEPARTMENT OF COMMERCE SUBMITTED FOR THE FISCAL YEAR 1922 WITH THE APPROPRIATIONS MADE BY CONGRESS FOR THE FISCAL YEAR 1921—Continued.

	Estimates, 1922.	Appropriations. 1921.	Increase.	Decrease.
LIGHTHOUSE SERVICE—continued.				
Public works:				
Tenders and light vessels	$5,000,000	.....	$5,000,000	.....
Fifth lighthouse district depot	400,000	.....	400,000	.....
Delaware Bay Entrance, aids to navigation	148,500	.....	148,500	.....
Cape Spencer, Alaska Lighthouse Service	185,000	.....	185,000	.....
Hawaiian Islands, lighthouse depot	120,000	.....	120,000	.....
Seventh lighthouse district depot	250,000	.....	250,000	.....
Potomac River, aids to navigation	95,000	.....	95,000	.....
Newport, R. I., lighthouse depot	82,300	.....	82,300	.....
Eighth lighthouse district depot	132,750	.....	132,750	.....
Alaska, aids to navigation	125,000	.....	125,000	.....
Charleston, S. C., lighthouse depot	60,000	.....	60,000	.....
Detroit, Mich., lighthouse depot	50,000	.....	50,000	.....
Virgin Islands, aids to navigation	50,000	.....	50,000	.....
Ludington, Mich., aids to navigation	75,000	.....	75,000	.....
Tampa Bay, aids to navigation	17,500	.....	17,500	.....
Depot keepers' dwellings	18,000	.....	18,000	.....
Galveston Jetty, Lighthouse Service	6,500	.....	6,500	.....
Calumet Harbor, Ill., aids to navigation	66,000	.....	66,000	.....
Second lighthouse district depot	140,000	.....	140,000	.....
San Juan, P. R., lighthouse depot	72,000	.....	72,000	.....
Ketchikan, Alaska, lighthouse depot	80,000	.....	80,000	.....
California, aids to navigation	25,000	.....	25,000	.....
Lansing Shoal, Mich., Lighthouse Service	304,000	.....	304,000	.....
Florida coasts, aids to navigation	150,000	.....	150,000	.....
Goat Island, Calif., lighthouse depot	80,700	.....	80,700	.....
Sandusky, Ohio, aids to navigation	126,000	.....	126,000	.....
Oswego, N. Y., aids to navigation	16,000	.....	16,000	.....
Total	17,429,790	$7,837,290	9,592,500	.....
BUREAU OF FOREIGN AND DOMESTIC COMMERCE.				
Salaries	315,270	220,510	94,760	.....
Commercial attachés	300,000	171,000	129,000	.....
Promoting commerce	500,000	325,000	175,000	.....
Promoting commerce, South and Central America	150,000	100,000	50,000	.....
Promoting commerce, Far East	150,000	100,000	50,000	.....
Post allowances	25,000	.....	25,000	.....
Transportation of families	50,000	.....	50,000	.....
Transporting remains	3,000	.....	3,000	.....
Total	1,493,270	916,510	576,760	.....
BUREAU OF THE CENSUS.				
Expenses, Fourteenth Census	1,215,000	5,000,000	.....	$3,785,000
STEAMBOAT-INSPECTION SERVICE.				
Salaries, office of Supervising Inspector General	23,940	22,940	1,000	.....
Salaries, Steamboat-Inspection Service	767,550	697,950	69,600	.....

COMPARISON OF THE ITEMS OF ESTIMATES FOR THE DEPARTMENT OF COMMERCE SUBMITTED FOR THE FISCAL YEAR 1922 WITH THE APPROPRIATIONS MADE BY CONGRESS FOR THE FISCAL YEAR 1921—Continued.

	Estimates, 1922.	Appropriations. 1921.	Increase.	Decrease.
STEAMBOAT-INSPECTION SERVICE—continued.				
Clerk hire	$136,200	$115,000	$21,200	.....
Contingent expenses	200,000	160,000	40,000	.....
Total	1,127,690	995,890	131,800	.....
BUREAU OF NAVIGATION.				
Salaries, Bureau of Navigation	48,080	42,530	5,550	.....
Salaries, Shipping Service	45,100	35,200	9,900	.....
Clerk hire, Shipping Service	92,870	70,000	22,870	.....
Contingent expenses, Shipping Service	11,660	10,000	1,660	.....
Admeasurement of vessels	4,100	3,760	340	.....
Instruments for counting passengers	250	250	.....	.....
Enforcement of navigation laws	75,400	75,400	.....	.....
Preventing overcrowding of vessels	18,000	18,000	.....	.....
Enforcement of wireless-communication laws	117,430	60,000	57,430	.....
Total	412,890	315,140	97,750	.....
BUREAU OF STANDARDS.				
Salaries	572,440	432,360	140,080	.....
Equipment	90,000	75,000	15,000	.....
Repairs and alterations	25,000	20,000	5,000	.....
General expenses	85,000	75,000	10,000	.....
Improvement and care of grounds	10,000	10,000	.....	.....
Testing structural materials	175,000	125,000	50,000	.....
Testing machines	45,000	30,000	15,000	.....
Investigating fire-resisting properties	50,000	25,000	25,000	.....
Public-utilities investigation	125,000	85,000	40,000	.....
Testing miscellaneous materials	50,000	30,000	20,000	.....
Radio-communication research	50,000	30,000	20,000	.....
Color standardization	12,000	10,000	2,000	.....
Investigating clay products	35,000	25,000	10,000	.....
Standardization of mechanical appliances	45,000	15,000	30,000	.....
Investigation of optical glass	40,000	25,000	15,000	.....
Investigation of textiles	40,000	15,000	25,000	.....
Sugar standardization	40,000	30,000	10,000	.....
Gauge standardization	45,000	40,000	5,000	.....
Mine-scale investigation	25,000	15,000	10,000	.....
Metallurgical research	70,000	25,000	45,000	.....
Railway-material investigation	.....	15,000	.....	$15,000
High-temperature investigation	15,000	10,000	5,000	.....
Sound investigation	15,000	5,000	10,000	.....
Industrial research	250,000	50,000	200,000	.....
Physical constants	25,000	.....	25,000	.....
Standard materials	15,000	.....	15,000	.....
Industrial safety standards	25,000	.....	25,000	.....
Standardization of instruments	25,000	.....	25,000	.....
Electrodeposition of metals investigation	15,000	.....	15,000	.....
Weights and measures cooperation	20,000	.....	20,000	.....
Internal-combustion engines investigation	100,000	.....	100,000	.....
Low-temperature research	15,000	.....	15,000	.....

COMPARISON OF THE ITEMS OF ESTIMATES FOR THE DEPARTMENT OF COMMERCE SUBMITTED FOR THE FISCAL YEAR 1922 WITH THE APPROPRIATIONS MADE BY CONGRESS FOR THE FISCAL YEAR 1921—Continued.

	Estimates, 1922.	Appropriations. 1921.	Increase.	Decrease.
BUREAU OF STANDARDS—continued.				
Aeronautic-instrument investigation	$15,000		$15,000	
Radioactive-substances investigation	15,000		15,000	
Testing large scales	50,000	$10,000	10,000	
Test-car depot	50,000		50,000	
Power-plant building	50,000		50,000	
Additional land		47,272		$47,272
Total	2,329,440	1,304,632	1,087,080	62,272
Decrease			62,272	
Net increase			1,024,808	
COAST AND GEODETIC SURVEY.				
Party expenses	883,521	524,280	359,241	
Repairs of vessels	97,500	64,000	33,500	
Pay, etc., officers and men	599,420	528,000	71,420	
Pay, commissioned officers	602,050	510,797	91,253	
Salaries	363,220	308,270	54,950	
General expenses	125,000	90,000	35,000	
Filing cases	10,000		10,000	
New vessels	1,210,000		1,240,000	
New launches	68,000		68,000	
Alteration of vessels		14,600		14,600
Skylight		1,500		1,500
Total	3,988,711	2,041,447	1,963,364	16,100
Decrease			16,100	
Net increase			1,947,264	
BUREAU OF FISHERIES.				
Salaries	631,390	474,810	156,580	
Miscellaneous expenses	909,000	726,500	182,500	
Fish hatchery:				
Duluth, Minn.	13,000		13,000	
Nashua, N. H.	20,000		20,000	
St. Johnsbury, Vt.	10,000		10,000	
Saratoga, Wyo.	11,250		11,250	
Yes Bay, Alaska	12,000		12,000	
Utilization Pacific coast fisheries	10,000		10,000	
Fish-cookery demonstrations	15,000		15,000	
Alaska fur-seal islands buildings		10,000		10,000
Total	1,631,640	1,211,31	430,330	10,000
Decrease			10,000	
Net increase			420,330	
Printing and binding	410,000	325,000	85,000	
RECAPITULATION.				
Office of the Secretary	345,050	314,550	30,500	
Lighthouse Service	17,429,790	7,837,290	9,592,500	
Bureau of Foreign and Domestic Commerce	1,493,270	916,510	576,760	

COMPARISON OF THE ITEMS OF ESTIMATES FOR THE DEPARTMENT OF COMMERCE SUBMITTED FOR THE FISCAL YEAR 1922 WITH THE APPROPRIATIONS MADE BY CONGRESS FOR THE FISCAL YEAR 1921—Continued.

	Estimates, 1922.	Appropriations. 1921.	Increase.	Decrease.
RECAPITULATION—continued.				
Bureau of the Census	$1,215,000	$5,000,000	.....	$3,785,000
Steamboat-Inspection Service	1,127,690	995,890	$131,800	.....
Bureau of Navigation	412,890	315,140	97,750	.....
Bureau of Standards	2,329,440	1,304,632	1,087,080	62,272
Coast and Geodetic Survey	3,988,711	2,041,447	1,963,364	16,100
Bureau of Fisheries	1,631,640	1,211,310	430,330	10,000
Printing and binding	410,000	325,000	85,000	.....
Total	30,383,481	20,261,769	13,995,084	3,873,372
Decrease	.....	.....	3,873,372	.....
Net increase	.....	.....	10,121,712	.....

The estimates submitted for the Lighthouse Service represent an increase of $9,592,500 over the appropriations for 1921. Of this increase approximately $1,700,000 is requested for the field service and is required to meet the increasing cost of supplies and materials. It is also desired to increase to a living wage salaries and pay of employees of this important Service who do not come within the purview of the contemplated reclassification of salaries.

With reference to the estimates for public works in the Lighthouse Service, 10 of the items, aggregating $5,772,500, have been authorized in full by Congress; 5 other items, previously authorized by Congress in the sum of $462,500, are submitted in an increased amount of $288,000, owing to advances in cost of labor and materials since these items were originally submitted. Twelve items, amounting to $1,640,250, have not been authorized by Congress, although certain of them are related to works that have been authorized or appropriated for.

An increase of $22,250 for salaries, Bureau of Lighthouses, is requested for the purpose of removing marked disparities and adjusting unjustifiable inequalities now existing between rates of pay in the Lighthouse Service and other services of the Government in Washington, and for the purpose of retaining employees competent to properly handle important and specialized technical work.

The increase requested for the Bureau of Foreign and Domestic Commerce, amounting to $576,760, is deemed essential to enable that Bureau to carry on its work in this country and abroad.

The estimate of $1,215,000 for the Bureau of the Census is $3,785,000 less than the appropriation carried in the legislative act for

1921. For the fiscal year 1921 the Department requested for this Bureau the sum of $6,215,000, but Congress appropriated only $5,000,000. It was found necessary to ask for a deficiency appropriation of $2,550,000 to cover the additional cost of the field work resulting from the abnormal conditions existing at the time of the census enumeration, and an appropriation in that amount was made by Congress in the deficiency act approved March 6, 1920.

The estimated cost of the decennial census work, together with the annual and other nondecennial investigations to be carried on during the three-year census period, is $23,765,000. Congress has appropriated $22,550,000 to cover this work. During the fiscal year 1920 the Bureau's expenditures and liabilities amounted to $13,844,000, and it is estimated that during the fiscal year ending June 30, 1921, $6,694,000 will be expended, making a total of $20,538,000. This would leave a balance of $2,012,000 available for the fiscal year ending June 30, 1922, the last year of the decennial census period. It is believed that this balance, together with the amount estimated for the fiscal year ending June 30, 1922 ($1,215,000), will be sufficient to enable the Bureau to complete the Fourteenth Census work and to issue the publications within the three-year census period as prescribed by law.

For the Steamboat-Inspection Service $131,800 in excess of the appropriations for the current year is requested in order to enable that Service to provide additional inspectors and clerks to carry on the inspection of steam vessels required by law and to meet the increased cost of travel necessary in connection with such inspections.

The increase of $97,750 for the Bureau of Navigation is required in its work in connection with the increased shipping and to enable that Bureau to keep abreast of the requirements imposed by the laws relating to wireless communication.

Many new investigations were undertaken by the Bureau of Standards during the war which have resulted in much good to the military and civil activities of the country, and to further carry on these inquiries increased appropriations to the extent of $1,087,080 are submitted for that Bureau.

The estimates for the Coast and Geodetic Survey are $1,963,364 in excess of the appropriations for 1921, $1,308,000 of this amount being for vessels and launches urgently needed. Of the balance, $359,241 is required to carry on work interrupted by the war and to meet the demands of other Government departments and civil undertakings, especially rail and water transportation.

The Bureau of Fisheries has been unable to properly carry on the work of propagating food fishes and other important activities because of the low pay provided for its employees, many of whom have

left the service for more remunerative employments. A large portion of the $420,330 increase requested is to enable that Bureau to compete with other employments and to function as contemplated by law.

The Department's estimate for printing and binding for 1922 is $85,000 in excess of the appropriation for the present fiscal year. Of this amount $58,000 represents an increase for the use of the Bureau of Foreign and Domestic Commerce and $27,000 represents an increase for the other bureaus, offices, and services of the Department.

TRAVEL ALLOWANCE.

I desire to invite attention to the inadequate subsistence allowance for employees traveling on official business. The maximum now allowed is $5 a day or $4 in lieu of subsistence. It is not fair to compel employees traveling for the Government to defray part of their actual necessary expenses from their own funds. This is being done daily by employees of this Department, and I can not too strongly urge that the law be amended to remedy the condition now existing.

NEED OF NATIONAL ARCHIVES BUILDING.

The act of March 4, 1913 (37 Stat. L., p. 866), authorized the Secretary of the Treasury to prepare designs, etc., for a national archives building. The necessity for such a building becomes more apparent each day. When the building is erected the Department could use to advantage 85,000 cubic feet therein. There are in possession of the Department many valuable papers which should be safeguarded in an archives building. These papers consist of valuable census returns and records which could not be duplicated, statistical publications and reports going back as far as 1847, records of scientific inquiries, technical papers, shipping records and copies of documents of vessels from 1813 to date, and correspondence and records of rulings, etc., under the steamboat-inspection laws. These papers possess permanent value and historical interest, and it is to be hoped that the construction of an archives building may be begun in the near future.

DEPARTMENT'S EXHIBIT AT NATIONAL MARINE LEAGUE EXPOSITION.

Under authority of Senate joint resolution 148, the Department furnished a very attractive and representative exhibit at the National Marine League Exposition, held at Grand Central Palace, New York, April 12 to 17, 1920. The exhibit was of great educational value, attracted much attention, and enabled the public to become better acquainted with the work of several of the Department's bureaus.

ADDITIONAL MEMBERS OF CREW OF STEAMER "KROONLAND" LOCATED.

During the past year the Department has been able to locate two members of the crew of the steamer *Kroonland*, namely, Gerard Frans Borrenberg and Desire Auguste Coopman, who, in October, 1913, assisted in rescuing the passengers of the burning steamer *Volturno*, and the medals awarded by Congress were forwarded to them through the Department of State.

Medals are still on hand for delivery to the following members of the crew of the *Kroonland:* Franz Quednau, Heinrich Schaub, Gustav Ebling, Ernst Benecke, August Frederic Reckzugel, Heike M. P. Janssen, Henri Guelinckx, Petrus Stobbelaar, and Leon Coppens. The remainder of the fund appropriated for the purchase of these medals, amounting to $236.12, has been covered into the Treasury, there appearing to be no more expenditures to be made therefrom.

MOTOR VEHICLES USED BY DEPARTMENT.

The Department operates from the Commerce Building three automobile trucks, one of 500 pounds, one of 1,500 pounds, and one of 2,000 pounds capacity.

The following table shows the operation data of these trucks for the fiscal year 1920:

Item.	500-pound truck.	1,500-pound truck.	2,000-pound truck.
Mileage	8,207	8,091	7,934
Operating days	293	272	265
Average miles per diem	28.01	29.74	29.93
Gasoline consumption (gallons)	624	927	987
Miles per gallon of gasoline	13.15	8.73	8.04
Cylinder-oil consumption (gallons)	14.37	36.44	40.37
Miles per gallon of oil	570.91	222.05	196.51
Operating expenses:			
Tires and tubes	$153.90	$358.40	$381.30
Repairs to tires and tubes	12.30	9.62	16.28
Miscellaneous supplies [1]	42.81	42.82	42.81
Gasoline	152.44	234.35	254.59
Cylinder oil	6.46	16.39	18.16
Repairs to machines	154.83	415.45	362.88
Replacements	61.35	91.55	99.66
Total	584.09	1,168.58	1,175.68
Cost per mile per vehicle	.0712	.1321	.1494

[1] This covers grease, soap, paint, oil, waste cotton, chamois skins, etc., used in cleaning and polishing machines.

TYPEWRITERS PURCHASED.

During the year 445 typewriters were purchased at a total cost of $27,157.36. The allowance given on old machines was $2,445, making a total net cost of $24,712.36, an average of $55.53 for each typewriter.

PERSONNEL.

The accompanying table shows, by bureaus, the number of permanent positions in the Department on July 1, 1920, and the increase or decrease in each bureau as compared with July 1, 1919. The figures do not include temporary appointments, nor do they include the following appointments or employments not made by the head of the Department: Persons engaged in rodding, chaining, recording, heliotroping, etc., in field parties of the Coast and Geodetic Survey; temporary employments in field operations of the Bureau of Fisheries; mechanics, skilled tradesmen, and laborers employed in field construction work in the Lighthouse Service. Enlisted men on vessels of the Coast and Geodetic Survey in the Philippine Islands and officers and men of the Navy Department employed on vessels of the Bureau of Fisheries are also excluded. The total of these excluded miscellaneous employments and enlistments is approximately 4,234, as compared with 5,000 for the fiscal year 1919. At the close of the fiscal year 1920 there were 1,705 employees in the service of the Department serving under temporary appointment or employment.

The total number of permanent positions referred to in the accompanying table, together with the employments and enlistments just mentioned, on July 1, 1920, was approximately 18,249, as compared with 12,349 on July 1, 1919.

Bureau.	Statutory.	Non-statutory.	Total.	In District of Columbia.	Outside District of Columbia.	Increase (+) or decrease (−).
Office of the Secretary	183	.....	183	183	.....	.....
Bureau of the Census	636	6,777	[1] 7,413	[2] 5,265	2,148	+6,065
Bureau of Foreign and Domestic Commerce	153	159	312	[2] 189	123	+ 7
Bureau of Standards	342	558	900	868	32	− 96
Bureau of Fisheries	423	8	431	81	350	+ 3
Bureau of Lighthouses	56	5,764	[3] 5,820	40	5,780	+ 2
Coast and Geodetic Survey	344	517	861	[2] 364	497	− 81
Bureau of Navigation	[4] 49	168	217	39	178	+ 13
Steamboat-Inspection Service	311	96	407	14	393	− 1
Total	2,497	14,047	16,544	7,043	9,501	+5,912

[1] The data for the Bureau of the Census includes upward of 5,250 temporary Fourteenth Decennial Census positions which, under the law, must terminate on or before June 30, 1922; also 650 cotton agents employed in the field; but does not include 563 seven-hour employees nor 327 four-hour employees on the night punching-machine force in Washington.

[2] Employees engaged in work in the field for a part of each year, with headquarters in Washington, are treated as within the District of Columbia.

[3] Includes the following positions, appointments to which are not made by the head of the Department: 408 mechanics, skilled tradesmen, and laborers employed in field construction work in the Lighthouse Service and work of a similar character at the general lighthouse depot at Tompkinsville, N. Y.; 1,499 laborers in charge of post lights (lamplighters), 253 laborers in charge (light attendants), and 1,358 members of crews of vessels.

[4] Includes 2 stenographers and typewriters authorized by law for not exceeding 6 months each during the year.

The following table gives a summary of changes in the personnel of the Department for the fiscal year ended June 30, 1920:

Bureau.	Appointments.[1]						Promotions.	Reductions.
	Permanent.				Temporary.	Grand total.		
	Competitive.	Excepted.	Unclassified.	Total.				
Office of the Secretary	47	6	9	62	29	91	54	2
Bureau of the Census	2,501	.....	2,451	4,952	3,559	8,511	4,967	136
Bureau of Foreign and Domestic Commerce	44	42	4	90	33	123	200	15
Bureau of Standards	281	3	35	319	517	836	573	43
Bureau of Fisheries	52	8	18	78	89	167	23	3
Bureau of Lighthouses	349	1	.....	350	383	733	545	71
Coast and Geodetic Survey	38	5	8	51	97	148	412	6
Bureau of Navigation	46	7	11	64	95	159	73	.....
Steamboat-Inspection Service	56	.....	1	57	13	70	24	2
Total	3,414	72	2,537	6,023	4,815	10,838	6,871	278

Bureau.	Separations.[2]						Miscellaneous changes.[3]
	From permanent positions.				From temporary positions.	Grand total.	
	Competitive.	Excepted.	Unclassified.	Total.			
Office of the Secretary	74	1	5	80	30	110	14
Bureau of the Census[4]	413	.....	543	956	915	1,871	341
Bureau of Foreign and Domestic Commerce	68	28	2	98	67	165	39
Bureau of Standards	367	.....	30	397	453	850	106
Bureau of Fisheries	64	2	11	77	61	138	21
Bureau of Lighthouses	382	.....	.....	382	298	680	84
Coast and Geodetic Survey	61	1	23	85	57	142	23
Bureau of Navigation	30	5	3	38	53	91	18
Steamboat-Inspection Service	50	.....	.....	50	7	57	6
Total	1,509	37	617	2,163	1,941	4,104	652

[1] Includes appointments of the following character: Presidential, by selection from civil-service certificates, under Executive order, to excepted positions, by reinstatement, and by reason of transfer within the Department or from other departments or independent establishments.

[2] Includes separations by reason of resignations, discontinuances, removals, deaths, transfers within the Department, and transfers from the Department to other departments or independent establishments.

[3] Includes reappointments by reason of change of station, name, designation, extension of temporary appointments, changes from temporary to permanent status, etc.

[4] Includes for the Bureau of the Census all employees, although the majority of changes apply to the additional force authorized during the Fourteenth Decennial Census period to be made by the Director of the Census.

Omitting from consideration the Bureau of the Census, which is now passing through the Fourteenth Decennial Census period, when conditions are abnormal, this statement shows a turnover during the year of over 50 per cent. This is excessive and is detrimental to economical and efficient service. The most frequent cause of separation is a dissatisfaction of conditions, especially with reference to compensation and a necessity to accept better-paid opportunities offered outside the service.

In spite of pressure on behalf of surplus war employees in efforts to secure positions as attractive as those held by them during the war, the Department has generally been able to adhere to its established practice of filling its higher-grade vacancies by promotions and accepting by transfer only those willing to take the entrance salary of the several grades. The policy of promoting employes wherever possible applies not only to the immediate circle (bureau or division), but to the Department as a whole. If a bureau has no employee eligible for promotion, the employees of other bureaus are considered.

The review of leave statistics for the calendar year 1919 shows that while the average annual leave (26.69 days) exceeds slightly the average for 1918 and 1917, when the pressure of public business caused a restriction of the privilege, it is below the average for the prewar years. The average for sick leave (7.42 days) is slightly higher than that for the six previous years (7.30 days). In refutation of the generally accepted statement that the average Government employee takes 30 days annual and 30 days sick leave, the survey of leave records shows that only 4 per cent of the employees of this Department utilized sick leave to such an extent.

TOTAL AND AVERAGE AMOUNT OF ANNUAL AND SICK LEAVE, BY BUREAUS, STATED SEPARATELY AND TOGETHER, TAKEN BY EMPLOYEES OF THE DEPARTMENT IN THE DISTRICT OF COLUMBIA, ARRANGED ACCORDING TO SEX, DURING THE CALENDAR YEAR 1919, AND AVERAGE LEAVE FOR 1918.

MALE.

Bureau.	Number.[1]	Annual leave.[2]		Sick leave.		Total.		Average, 1918.
		Days.	Average.	Days.	Average.	Days.	Average.	
Office of the Secretary	75	1,942	25.89	429	5.72	2,371	31.61	33.21
Bureau of the Census	295	7,158	24.26	1,888	6.40	9,046	30.66	36.45
Bureau of Foreign and Domestic Commerce	77	2,091	27.16	536	6.96	2,627	34.12	37.35

[1] Only those employees are included who were considered as being entitled to the full yearly allowance of both annual and sick leave.

[2] In the count of the annual leave all periods of one-half day and over are counted as a full day; periods of less than one-half day are omitted.

TOTAL AND AVERAGE AMOUNT OF ANNUAL AND SICK LEAVE BY BUREAUS, STATED SEPARATELY AND TOGETHER, ETC.—Continued.

MALE—Continued.

Bureau.	Number.	Annual leave.		Sick leave.		Total.		Average, 1918.
		Days.	Average.	Days.	Average.	Days.	Average.	
Bureau of Standards	438	10,782	24.62	2,116	4.83	12,898	29.45	20.04
Bureau of Fisheries	38	957	25.18	165	4.34	1,122	29.52	31.56
Bureau of Lighthouses	15	423	28.20	116	7.73	539	35.93	38.95
Coast and Geodetic Survey	141	3,951	28.02	1,041	7.38	4,992	35.40	37.56
Bureau of Navigation	13	338	26.00	46	3.53	384	29.53	28.13
Steamboat-Inspection Service	5	143	28.60	7	1.40	150	30.00	36.40
Total and average	1,097	27,785	25.33	6,344	5.78	34,129	31.11	29.85

FEMALE.

Office of the Secretary	49	1,420	28.98	500	10.21	1,920	39.18	38.56
Bureau of the Census	338	9,935	29.36	3,489	10.32	13,424	39.72	43.11
Bureau of Foreign and Domestic Commerce	51	1,590	29.41	585	11.47	2,085	40.88	45.12
Bureau of Standards	84	2,411	28.70	769	9.15	3,180	37.85	26.23
Bureau of Fisheries	23	639	27.78	231	10.04	870	37.82	40.59
Bureau of Lighthouses	3	89	29.66	55	18.34	144	48.00	46.50
Coast and Geodetic Survey	32	930	29.06	392	12.25	1,322	41.31	41.45
Bureau of Navigation	13	377	29.00	187	14.38	564	43.38	41.71
Steamboat-Inspection Service	7	208	29.71	44	6.29	252	36.00	39.00
Total and average	600	17,509	29.18	6,252	10.41	23,761	39.59	41.39

TOTAL.

Office of the Secretary	124	3,362	27.11	929	7.49	4,291	33.80	35.30
Bureau of the Census	633	17,093	27.01	5,377	8.02	22,470	33.76	39.54
Bureau of Foreign and Domestic Commerce	128	3,591	28.05	1,121	8.76	4,712	36.81	39.37
Bureau of Standards	522	13,193	25.27	2,885	5.34	16,078	30.61	20.42
Bureau of Fisheries	61	1,596	26.16	396	6.49	1,992	32.65	34.71
Bureau of Lighthouses	18	512	28.44	171	9.50	683	37.94	40.16
Coast and Geodetic Survey	173	4,881	28.21	1,433	8.28	6,314	36.49	38.09
Bureau of Navigation	26	715	27.50	233	8.96	948	36.46	32.26
Steamboat-Inspection Service	12	351	29.25	51	4.25	402	33.50	37.56
Total and average	1,697	45,294	26.69	12,596	7.42	57,890	34.11	33.05

The high cost of living is still with us and the insufficient compensation of Government employees still exists. The temporary makeshift of the $240 bonus allowed by Congress was renewed on the understanding that the work of the Congressional Joint Commission on Reclassification of Salaries would equalize the unsatisfactory conditions which have governed the compensation of Government employees for many years. This equalization has not been accomplished,

nor does it appear likely to be in the immediate future. Where possible the Department has been obliged to increase salaries in positions in its field force where the competition of outside service was too keen to enable it to retain employees without meeting salaries paid elsewhere. It is a matter of surprise that administrative, scientific, and technical men remain in the Government service at salaries much less than can be obtained by them elsewhere. Loyalty aids the Department in this respect, but loyalty has to submit to the inability to provide suitable food and clothing for one's family; hence the changes in these grades are many and expensive to the Department and to the Government service generally. A laborer in the Government service is expected to maintain himself on less than $900 a year, a clerk on $900 or $1,000 a year. Eligibles are difficult to obtain under these conditions. It is hoped that Congress will speedily adopt measures to relieve the situation.

The Congressional Joint Commission on Reclassification of Salaries has practically completed its work and made its report to Congress, but no haste has been exhibited to seriously consider its adoption. Congress has temporarily placed it in oblivion, and it is subjected to criticism more or less unfavorable by bodies of Federal employees. It is hoped that the work of this commission will not follow in the steps of those of similar commissions in the past. The question should be considered from a very broad point of view rather than whether it meets every individual's need in the service. It is generally accepted that there should be a standardization of physical and mental requirements for the several classes of positions in the Government service; that the probationary period should be generally one of training; that means should be afforded for a study of Government activities in general, this becoming a foundation upon which a specialist may build further study; that minimum compensation be based as approximately as possible on the cost of living; that for comparable positions there should be an equalization of salary on the basis of duties and responsibilities; that a less rigid system than statutory appropriations and a less flexible one than lump-sum appropriations is desirable in order that promotions may be given as earned and deserved rather than as fortune or misfortune may create vacancies; and that there should be more harmonious coordination between the various Government establishments. The commission in its report has endeavored to indicate how these aims may be attained. It will be unfortunate if the service generally can not profit by its efforts.

Retirement and disability pensions, which have been advocated in this report for several years, are at last an accomplished fact for Fed-

eral employees generally. They are to be congratulated upon the attainment of this result. It was not to be anticipated that such an important piece of legislation could be flawless, but the principle has been adopted and is in operation. Experience will develop weaknesses and indicate methods of improvement. The act was approved May 22, 1920, to be effective 90 days thereafter, and a preliminary investigation indicated that there were in this Department 89 employees of retirement age. Of these, 50 were recommended for retirement and 39 for continuance for a further period not exceeding two years. At the date of this report 42 had been retired with annuity, 2 without, and the continuance of 46 authorized for a period not exceeding two years. It is surprising to learn what a large proportion of employees 70 years of age and over are still rendering efficient service. Results so far indicate that the operation of the law will not be as costly to the Federal Treasury as was estimated. This might be a good ground for making an increase in the compensation rate which ranges from a minimum of $180 to a maximum of $720 per annum. Having in view the high cost of living even the maximum can not be considered other than as an aid to be supplemented from some other source. The retirement system for keepers and field employees of the Lighthouse Service, which is in its second year of operation, is working smoothly. During the last fiscal year 29 employees have been retired at an average compensation of $522.03. As compared with the civil-service retirement plan this system is noncontributory, compulsory at 70 years of age, and the compensation is directly proportioned to the years of service and average salary of the employee.

PRINTING AND BINDING.

The sundry civil appropriation act of July 19, 1919, allotted to the Department, exclusive of the Bureau of the Census, $300,000 for printing and binding during the fiscal year 1920. Of this sum, $299,995.97 was expended, leaving an unused balance on June 30 of $4.03. From allotments made to the Department from the national security and defense fund there was expended for printing and binding the sum of $17,943.08.

During the decennial-census period of three years beginning July 1, 1919, the Bureau of the Census will not participate in the Department's printing and binding allotment, as the work for that Bureau will be paid for from the appropriation for the Fourteenth Census. The estimated cost of unbilled and uncompleted work of the Department at the Government Printing Office on July 1, 1920, and chargeable against the allotment for 1921, was $42,103.57, while such work

at the Government Printing Office on the same date in 1919 actually cost $31,909.79.

The following table shows the cost of printing and binding for each of the bureaus, offices, and services of the Department, exclusive of the Bureau of the Census, during the fiscal years 1919 and 1920, together with the increase or decrease for each bureau, office, or service and the estimated cost of the work on hand but not completed June 30, 1920:

Bureau, office, or service.	Cost of work.		Increase (+) or decrease (−).		Estimated cost of work not completed June 30, 1920.
	1919	1920	Amount.	Per cent.	
Office of the Secretary (Secretary, Assistant Secretary, Solicitor, Chief Clerk, and Division of Publications)	$17,112.36	$15,528.73	−$1,583.63	− 9.25	$116.62
Appointment Division	645.34	446.77	− 198.57	− 30.77	24.20
Disbursing Office	1,101.97	622.65	− 479.32	− 43.50	9.91
Division of Supplies	344.32	505.98	+ 161.66	+ 46.95	.....
Coast and Geodetic Survey	30,607.79	37,489.48	+ 6,881.69	+ 22.48	2,174.13
Bureau of Fisheries	12,393.97	15,263.51	+ 2,869.54	+ 23.15	2,006.26
Bureau of Foreign and Domestic Commerce	120,198.30	127,909.69	+ 7,711.39	+ 6.42	24,301.02
Bureau of Lighthouses	16,595.33	15,170.04	− 1,425.29	− 8.59	196.47
Lighthouse Service	7,580.02	5,507.22	− 2,072.80	− 27.35	394.95
Bureau of Navigation	16,856.98	23,830.95	+ 6,973.97	+ 41.37	13.02
Shipping Service	5,835.92	5,492.45	− 343.47	− 5.89	2,729.47
Radio Service	635.44	785.01	+ 149.57	+ 23.54	156.78
Bureau of Standards	32,548.55	29,930.54	− 2,618.01	− 8.04	3,510.89
Office of the Supervising Inspector General, Steamboat-Inspection Service	1,187.98	1,432.26	+ 244.28	+ 20.56	.....
Steamboat-Inspection Service	13,192.28	14,199.64	+ 1,007.36	+ 7.64	6,159.75
Customs Service	9,153.59	5,881.05	− 3,272.54	− 35.75	310.10
Total	285,990.14	299,995.97	+14,005.83	+ 4.90	42,103.57
Expenditures chargeable against allotments from the national security and defense fund:					
Waste-Reclamation Service	684.20	.....	− 684.20	.....	.....
Industrial Cooperation Service	4,854.43	2,342.91	− 2,511.52	− 51.74	.....
Industrial Board	35.33	.....	− 35.33	.....	.....
Import and export statistics	.....	15,600.17	+15,600.17	.....	.....
Total	5,573.96	17,943.08	+12,369.12	+221.91	.....
Grand total	291,564.10	317,939.05	+26,374.95	+ 9.05	.....

The cost of each class of work during the fiscal years 1919 and 1920 is shown in the following statement:

Class.	1919 [1]	1920	Increase (+) or decrease (−).	
			Amount.	Per cent.
Blank forms	$31,451.93	$31,070.33	− $381.60	− 1.21
Reports, pamphlets, etc	223,702.93	257,032.13	+33,389.20	+14.93
Letterheads	4,663.72	3,465.74	− 1,197.98	−25.69
Envelopes	557.14	127.52	− 429.62	−77.11
Circulars, summaries, and notices	1,703.62	299.87	− 1,403.75	−82.40
Index cards	2,167.73	1,632.39	− 535.34	−24.70
Guide cards and folders	1,792.98	961.51	− 831.47	−46.37
Memorandum sheets	1,513.04	1,424.62	− 88.42	− 5.84
Blank books	18,247.89	15,320.10	− 2,927.79	−16.04
Miscellaneous books (binding)	5,106.78	5,361.69	+ 254.91	+ 4.99
Miscellaneous	656.34	1,183.15	+ 526.81	+80.26
Total [2]	291,564.10	317,939.05	+26,374.95	+ 9.05

[1] For comparative purposes, expenditures for the Bureau of the Census are omitted.

[2] Of these cost totals, expenditures from allotments from the national security and defense fund were as follows: 1919, $5,573.96; 1920, $17,943.08.

The following table relates to publications delivered to the Department during the years 1919 and 1920 and includes those issued by the Bureau of the Census. Frequently the cost of a publication is charged against allotments for two or more fiscal years; consequently the cost figures do not represent the actual amount expended in each year.

Bureau or office.	Publications.		Pages.		Copies printed for Department.		Cost.	
	1919	1920	1919	1920	1919	1920	1919	1920
Office of the Secretary	85	64	2,659	1,830	1,027,350	135,750	$18,403.67	$5,862.01
Bureau of the Census	49	55	17,282	8,631	215,350	1,398,951	86,301.14	160,862.76
Coast and Geodetic Survey	40	49	3,458	5,205	88,050	92,900	26,927.71	31,459.47
Bureau of Fisheries	65	59	1,808	1,034	159,350	57,400	6,014.94	10,800.70
Bureau of Foreign and Domestic Commerce	554	465	17,519	17,961	2,368,900	2,207,690	114,848.62	147,011.24
Bureau of Lighthouses	93	94	2,910	3,011	327,650	272,850	16,521.10	16,237.82
Bureau of Navigation	8	33	2,047	3,069	25,025	96,500	15,097.34	22,117.25
Bureau of Standards	104	135	5,169	5,196	215,150	240,350	19,180.87	24,498.97
Steamboat-Inspection Service	21	21	886	808	274,900	228,700	8,600.85	6,520.53
Total	1,019	975	53,738	46,745	4,701,725	4,731,091	311,896.24	425,370.75

The increased printing and binding needs of the Department, with no increase in printing funds and a greatly advanced scale of charges for work, prevented the printing during the year of a considerable amount of important publication work. Many printing economies were effected by the Department's editorial clerks in the careful analysis and preparation of manuscripts before they were forwarded to the Government Printing Office. However, with the limited number of employees available for this class of work and the fact that capable editorial clerks can not be secured at the low entrance salaries paid the regular departmental clerk, the Department is not able to give its great volume of publication work the critical editorial attention and proof revision it should receive. An increase in the force of the Division of Publications is necessary to meet this need, and higher salaries should be provided to enable the Department to secure and retain efficient and technically trained employees. Experience justifies the assertion that a competent editorial clerk will save the cost of his salary several times over by introducing physical printing economies in the manuscripts submitted for publication.

The Department issues annually, with monthly supplements, a pamphlet containing a complete list of its publications available either for free distribution by the Department or by purchase from the Superintendent of Documents. This list is sent free of charge to all applicants. Most of the publications of the Department, however, are printed in limited editions, free distribution being confined to Government officials, Members of Congress, commercial organizations, libraries, educational institutions, etc. The Superintendent of Documents maintains a sales stock of such publications so long as there is a reasonably active demand for them, which are sold by his office at a nominal price, based upon the cost of reprinting from electrotype plates. Coast pilots, inside route pilots, tide tables, and charts are sold by the Coast and Geodetic Survey.

The statement on page 42 is compiled from figures furnished by the office of the Superintendent of Documents and the Coast and Geodetic Survey and indicates a substantial demand for the Department's publications from persons who are willing to and do purchase them:

Sales.	Copies.			Receipts.		
	1918	1919	1920 [1]	1918	1919	1920 [1]
By Superintendent of Documents:						
Annual subscriptions	2,884,213	2,476,986	2,843,658	$15,921.04	$19,301.10	$19,149.90
Through miscellaneous sales	90,047	117,197	152,314	16,965.75	23,829.81	31,625.10
Total	2,974,260	2,594,183	2,995,972	32,886.79	43,130.91	50,775.00
By Coast and Geodetic Survey: Coast pilots, inside route pilots, tide tables, and charts				20,194.19	24,620.71	35,902.47
Grand total				53,080.98	67,751.62	86,677.47

[1] Preliminary figures.

During the past fiscal year 3,361,378 publications and printed circulars of the Department were distributed to the public through the Division of Publications (335,041 copies being distributed by the Division direct and 3,026,337 being mailed by the Superintendent of Documents). The character of some of the publications of the Department is such that their distribution is made through the issuing bureaus or their field offices. Such distribution is not included in these figures.

Mailing lists for use in sending typewritten or multigraphed information, as well as publications, are maintained by the Department. On July 1, 1920, there were 365 of such lists, containing 253,256 names.

During the year the Department expended $3,120.01 for advertising for proposals for furnishing supplies of various kinds for construction work, and for the purchase of condemned property.

DIVISION OF SUPPLIES.

During the year the Division of Supplies handled 2,792 requisitions, and the clerical work in connection therewith included the writing of 4,227 orders and 6,901 invoices. Supplies ordered through the Division during the fiscal year reached a total value of $208,190.26, and 4,907 vouchers were audited for payment.

STOCK AND SHIPPING SECTION.

The stock and shipping section received and filled during the year 6,261 requisitions for supplies of all kinds, of which 2,187 were for the offices and bureaus of the Department located in Washington and 4,074 were for the outside services. Of the total number of requisitions received, 1,884 were blank forms, 390 were for printed stationery, and 3,987 were for miscellaneous stationery supplies.

It required for the filling of the 4,074 requisitions the packing and shipping of 5,808 pieces, weighing 203,255 pounds, or over 101 tons, of which 4,575 pieces, weighing 118,198 pounds, were sent by ordinary mail, 194 pieces, weighing 2,126 pounds, were sent by registered mail, and 1,039 pieces, weighing 82,931 pounds, were sent by freight or express.

The following table shows the number of books and blanks sent to each of the outside services during the year:

Service.	Blank books.	Blank forms.
Customs Service (Bureau of Navigation and Foreign and Domestic Commerce)	4,513	1,186,372
Fisheries service	279	512,975
Lighthouse Service	9,712	1,111,509
Bureau of Navigation:		
Shipping Service	17,144	416,963
Radio Service	727	243,455
Steamboat-Inspection Service	232,762	904,517
Miscellaneous	249	180,814
Total	265,386	4,556,605

The following statement gives the quantity of each class of printed stationery supplied during the year:

	Number.		Number.
Letterheads	462,500	Blank forms	150,679
Memorandum sheets	2,324,300	Index cards	592,900
Embossed letterheads	8,500	Guide cards	42,750
Stenographers' notebooks	2,695	Vertical folders	75,850
Blank books	5,034	Continuation sheets	306,500

DEPARTMENT'S LIBRARY.

The Department's library, which contains approximately 100,000 volumes, is one of the most complete and valuable reference libraries in existence. Its real value is attested daily by the service it renders, not only to this and other Government departments and establishments, but to private individuals interested in the development of foreign trade and other matters.

During the fiscal year ended June 30, 1920, the library acquired 1,277 bound volumes and 1,597 pamphlets, compared with 2,244 bound volumes and 562 pamphlets for the previous year.

Duplicates disposed of numbered 1,130, and 565 books were borrowed from the Library of Congress and other libraries. Approximately 987 monthly and weekly periodicals were currently received, recorded, and distributed to the various bureaus.

WORK OF THE SOLICITOR'S OFFICE.

During the fiscal year ended June 30, 1920, 285 contracts, totaling $2,582,201.40, together with 14 contracts of indeterminate amounts; 78 leases, amounting to $86,658; 13 revocable licenses, amounting to $1,569; 6 deeds, in the sum of $4,200; 121 contract bonds, amounting to $543,416.45; 68 official bonds, amounting to $380,000; and insurance policies amounting to $361,000 were examined (approved, disapproved, drafted, redrafted, or modified).

The number of legal opinions rendered, formal and informal (memorandum), totaled 285. Legislative matters handled, which concern the Department (drafting and redrafting of bills, reports relative thereto, etc.), numbered 94. In addition, 1,085 miscellaneous matters, embracing everything submitted for the advice or suggestion of the Solicitor or for the formulation of departmental action, not included in the foregoing items, were handled by this office.

BUREAU OF THE CENSUS.

The first year of the Fourteenth Decennial Census period has expired. Adequate legislation for the taking of the census was provided on March 3, 1919. The organization was perfected, the preliminary work accomplished opportunely, a building obtained and made suitable for the Bureau's requirements, mechanical appliances manufactured or rented, installed, and made ready for use when needed, and the enumeration begun on January 2, 1920, as provided by law.

The field work for population and agriculture has been completed, and practically all the returns, except those for Alaska, are now in the hands of the Bureau. The population of Alaska has been enumerated, the returns for four districts have been received, and the returns for the remaining two districts will reach Washington early in November. Population bulletins have been issued for several States and the District of Columbia and for American Samoa, Hawaii, and Porto Rico (the latter published in both English and Spanish). Preliminary announcements of population have been made for all States, counties, cities, towns, villages, and other civil divisions of the United States, a total of 105,683,108 being announced October 7.

The field work on manufactures, mines and quarries, and oil and gas wells was begun in April, 1920, and is now practically completed.

The abnormal conditions under which the census was taken were unprecedented and could not have been anticipated when the estimates and preparations were made for the taking of the census. Nevertheless, I am glad to say that the many difficulties confronting the Bureau have been overcome and that the progress made on the work is gratifying. Expenditures have been kept within the limits of the estimate of the cost of the first year's work and the appropriations made therefor.

In building up a productive and efficient force the "turnover" has been enormous and exceedingly expensive. However, if the present trained organization can be held together, the Fourteenth Census work will be completed within the period prescribed by law.

In addition to the decennial-census work, the Bureau conducted its usual annual inquiries pertaining to births and deaths; finances of States and cities; production, distribution, and consumption of cotton, cotton seed, and cottonseed products; and tobacco stocks. Special inquiries were also made concerning active and idle wool machinery; hides, skins, and leather; and fats and oils.

FIELD WORK ON POPULATION AND AGRICULTURE.

The census of population and agriculture was taken as of date January 1 by a force consisting of 374 supervisors and about 87,000 enumerators, in addition to the special agents and clerks employed to assist the supervisors. The enumerators in cities of 2,500 inhabitants and over were allowed two weeks in which to complete their canvass, and those in the rural districts 30 days. It was found necessary, however, as at previous censuses, to allow a considerable amount of additional time for checking and perfecting the returns. Moreover, because of the impossibility of securing enumerators for certain districts, the supervisors were obliged in some cases to assign two districts to one enumerator, and this necessitated extending the time for the canvass.

THE CENSUS DATE.

The date January 1 was fixed by the Fourteenth Census act as that to which the census should relate. This census is the first which has been taken in the winter, all previous enumerations having been made in the spring or summer. January 1 was recommended by the Bureau for incorporation in the law as the census date in deference to the wishes of the Department of Agriculture and of the various interests making use of agricultural statistics. In some respects this date has decided advantages over any other for the purposes of an agricultural census. The past season's work on all farms has been finished by January 1, and the coming season's work has not, as a rule, been begun. Practically all farmers are occupying the farms which they operated during the preceding year, whereas a few months later many of the renters have left the farms they operated the year before and have begun work on different ones. Again, young farm animals are born in large numbers during the spring and early summer, but not in December or January, and therefore a live-stock census referring to January 1 is of far more value than one taken several months later.

But against these manifest advantages must be offset the pronounced disadvantage due to the inclement weather which is apt to prevail in many sections of the country in January. It happened that the weather in January, 1920, was worse than usual. In some of the enumeration districts the cold was so extreme and the snow was drifted to so great an extent as seriously to delay the work in the rural districts; and farther south the rains were so heavy as to make the country roads well-nigh impassable.

As a result of the delays due to bad weather, the field work of the Fourteenth Census was not brought to a close as soon as had been ex-

pected. Nevertheless, the returns were received rapidly enough to permit the work of compilation to begin and to be brought well under way at an earlier date than was possible at previous censuses.

APPOINTMENT OF SUPERVISORS AND ENUMERATORS.

The supervisors were appointed by the Secretary of Commerce upon the recommendation of the Director of the Census, and the enumerators were designated and employed by the supervisors with the consent of the Director. In order to aid in the selection of competent enumerators, tests of a practical character were held throughout the country by the supervisors. These tests were formulated in detail by the Census Bureau, and consisted essentially in filling out sample schedules for population and agriculture from hypothetical data set forth in narrative form. The purpose of the examination was really twofold: First, to test the applicant's ability to perform the duties of an enumerator, and, second, to familiarize him with those duties. Practically all the enumerators were given these tests, although in many cases, because of the great difficulty in obtaining applicants, the tests were in no sense competitive. The Bureau, however, insisted that the test be given wherever practicable—by mail, if it was not feasible to give it in any other way—because of its value in familiarizing the applicant with the duties he would have to perform if designated for appointment. Where it was possible and practicable to do so, the applicants were assembled in convenient places and the examination was conducted by the supervisor, his assistant, or in some cases by the postmaster.

In order to familiarize the public generally with the purpose of the census and to allay the fears in the minds of certain classes of the population that the information sought by it might be used to their detriment, a proclamation by the President, printed in 23 languages, was circulated through the press and by posting in post offices and other public places. Such other methods as were available were also used, and the press in particular rendered valuable assistance in bringing to public attention the importance of the census.

In the large cities the work, because of the great number of foreign-born persons, many of whom were inclined to be suspicious of the census, was much more difficult than in most rural regions. In those cities the supervisors were empowered to appoint assistants, designated as inspectors, whose duties were to exercise immediate supervision over the enumerators and to give them such aid and instruction as might be necessary. These inspectors were employed particularly in those sections of the cities populated largely by the foreign element, especially where tenements, apartment houses, and lodging houses were numerous. Those sections of cities which were made

up chiefly of ordinary dwelling houses presented no particular difficulties. When the enumerator merely had to go from house to house and get the census information from some member of each family capable of answering the various questions on the population schedule the work was comparatively simple and easy; but where the enumerator had to interview the proprietor or manager of a cheap lodging house, or a boarding-house keeper, or the janitor of an apartment house in order to obtain information regarding persons whom he was unable to interview directly, the difficulties were greatly increased.

The inaccuracies in the census due to these difficulties do not pertain so much to the mere counting of the population as to the securing of correct and reliable data concerning the persons counted. A reasonably conscientious and intelligent enumerator has little difficulty in ascertaining the number of persons in his district who are entitled to enumeration as bona fide residents of that district on the census date. He can ascertain this number without much trouble by visiting the various dwellings and learning how many persons were making their usual places of abode in those dwellings on the census date. But to interview the persons themselves and to obtain the various census data as to age, citizenship, mother tongue, occupation, etc., is exceedingly difficult in some cases, although the enumerators were instructed to make every effort to obtain this information correctly.

COMPLAINTS OF DEFECTIVE ENUMERATION.

The prosecutions of persons guilty of committing or attempting to commit census frauds in 1910 appear to have had a salutary deterrent effect, and, so far as can be ascertained by careful inspection of the census returns, there has been practically no attempt to commit fraud through "padding" the returns at this census. The difficulty, in fact, has been in the opposite direction. Because of the impossibility of securing competent enumerators in some cases, there have been a few instances of neglect of duty on the part of the enumerators, resulting in seriously incomplete enumeration, which has necessitated reenumerating the districts or checking the work of the original enumerators for the purpose of making the needed corrections of and additions to the returns.

Because of the fact that the rate of increase in the population of the country has been materially smaller for the past decade than for any preceding one in the history of the country (this decline being due to the practical cessation of immigration in 1914, and to a much less extent to the ravages of the influenza pandemic and the effects of the war), many cities and towns have been disappointed with the

census figures and have filed protests questioning their accuracy. In nearly all cases these protests have been accompanied by requests or demands for complete recounts. In very few instances, however, have the complainants submitted any genuine evidence of defective enumeration. Sometimes their complaints have been based upon estimates made by multiplying the total shown by a school census, for example, by some arbitrary factor—always too large—supposed to represent the ratio between the total population and the school population; but generally not even this sort of evidence has been presented, the complaints having been based merely upon the feeling or belief of the inhabitants of the city or town that it had a greater population than was shown by the census.

All these complaints have been met with the requirement that some genuine, tangible evidence of defective enumeration must be produced before the Bureau would consider taking any action looking toward a revision of the enumerators' returns. This evidence was to consist of a list of the names and addresses of persons claiming to have been bona fide residents of the city or town in question and to have been missed by the enumerators. In many cases the complainants appear to have made no effort to supply the evidence; in others they made the attempt, but later desisted.

In a relatively small number of cases, however, lists of names and addresses have been submitted to the Bureau. Each such list has been compared with the enumerators' returns, and the supervisor has been directed to make an official canvass of the persons whose names appeared on the complainants' list, but not on the enumerators' returns, for the purpose of officially enumerating such of them as were found to have been bona fide residents on January 1 of the city or town under investigation. In any case where a city or town has been able to demonstrate in this manner that a particular portion was badly enumerated, the necessary corrections have been made, not only in the area under investigation but elsewhere, if there appeared to be good reason to believe that the enumeration in other parts of the city or town had been defective.

There appear to have been no serious defects in the enumeration of any of the large or medium-sized cities, although a few cases of defective enumeration in some smaller places and in certain sections of large cities have been discovered and corrected.

COST OF FIELD WORK.

The cost of the field work in connection with the enumeration of population and agriculture (exclusive of the expenditure for printing schedules, instructions, etc.) will reach approximately $9,345,000,

consisting of about $7,650,000 for enumerators and approximately $1,695,000 for salaries and traveling expenses of the supervisors and of the clerks and special agents employed to assist the supervisors and for the rental and maintenance of offices.

The Bureau's original intention had been to pay the large majority of the enumerators at rates below the maximum fixed by the census act. This maximum was 4 cents for each name where payment was made entirely on the per capita basis, $6 a day where payment was made entirely on the per diem basis, or a mixed rate of not more than $2 a day in addition to not more than 3 cents per capita. To these were added, in the case of the agricultural districts, various rates of compensation for the return of farm schedules, live-stock schedules, etc. It became apparent, however, in December, 1919, that it would be utterly impossible to obtain enumerators in many districts throughout the country unless the maximum rates were paid, and such rates were therefore established. All the enumerators who were paid on the per capita basis were accordingly paid 4 cents a name, and all those paid on the per diem basis were given $6 a day. In addition in the rural districts it was necessary in some cases to make an allowance of from $1 to $4 per diem in lieu of subsistence.

Thus the cost of the enumeration was very materially increased as compared with the corresponding cost in 1910. Nevertheless, the increase is not as great as the average increase in the cost of the necessaries of life between 1910 and 1920; that is to say, the total cost of the enumeration in 1920 would purchase a smaller amount of the necessaries of life than could have been purchased by a sum equal to the total cost of the enumeration in 1910. Moreover, the population of the country has increased since 1910, and therefore the per capita cost of the enumeration represents a still greater reduction when measured in commodity units.

In particular, the cost of supervision of the field work has shown a notable decrease when measured in commodity units. The basic compensation of each supervisor, $1,500, was the same as in 1910; the number of supervisors bore about the same ratio to the total population; and the additional compensation of $1 for each thousand or major fraction of a thousand population enumerated represents the same per capita rate as in 1910.

FIELD WORK ON CENSUSES OF IRRIGATION AND DRAINAGE.

The Fourteenth Census act included specific provisions for censuses of irrigation and drainage, the latter being an entirely new investigation. At the census of 1910 the farmers were asked to furnish information to the enumerators concerning crops grown by irrigation, and the more detailed reports concerning irrigation enterprises were collected by special agents on special schedules.

At the present census only one schedule was used for the collection of information concerning irrigation and one for the drainage data. These inquiries were conducted almost entirely independently of the census of agriculture, although forming a part of this more comprehensive investigation. However, about 40,000 irrigation schedules and 100 drainage schedules were collected by enumerators. Twenty thousand additional schedules of irrigation and almost 32,000 schedules of drainage were secured by special agents appointed for this purpose.

FIELD WORK ON MANUFACTURES, MINES AND QUARRIES, AND OIL AND GAS WELLS.

The census of manufactures has been a quinquennial inquiry since 1900, having been taken as a branch of each decennial census and constituting an independent inquiry in each mid-decennial year. As has been the Bureau's practice heretofore, the data on manufactures have been collected, so far as practicable, through correspondence, and in this way a considerable saving in the cost has been effected. At the present census the small manufacturing establishments in some of the rural districts were canvassed through the enumerators who collected the population and agricultural data.

The special agents engaged on the manufactures canvass in some cases have collected also the data for mines and quarries and oil and gas wells. In other cases special agents employed on the mines and quarries canvass have had no connection with the manufactures canvass.

In preparation for the field work continental United States (exclusive of Alaska) was divided into 607 districts, which were canvassed mainly by local special agents appointed for this purpose and by employees detailed from the office. In the larger metropolitan districts the work was placed under the charge of chief special agents, who exercised immediate supervision over the local agents, who made the canvass.

APPOINTMENT OF FIELD FORCE.

Under date of November 15, 1919, the Bureau issued a circular of information in regard to the appointments of local special agents for the field work on manufactures and mines and quarries, and as the result of this announcement approximately 3,000 persons applied for employment. A number of the Bureau's trained employees were sent into the field early in the year to interview these applicants and recommend for appointment those deemed to be best fitted for the work. A practical test was given, consisting of the filling out of a sample schedule. The manufactures field work requires men of good address and considerable intelligence and preferably men having had

some experience along accounting or statistical lines; but it was very difficult to secure a sufficient number of properly qualified agents, as the period of service was short, averaging only about three months, and the Bureau's appropriation did not permit it to offer a rate of compensation comparable with that which competent persons could receive in outside employment. Up to June 30, 1920, appointments for the field canvass had been offered to 1,629 persons, of whom 473 had declined to accept. The highest number of local manufactures employees on the rolls at any one time was 1,002, as shown by the report for June 30, 1920. The work at that time was well past its maximum and has since been brought practically to completion.

The great majority of the agents were paid on a piece-price basis at the rate of $1 for each acceptably correct schedule for an establishment listed on the Bureau's card index, and at the rate of $1.50 for each acceptably correct schedule for an establishment not so listed, with the proviso that the compensation to be paid should average at least $3.50 a day based upon the total number of days actually employed. Under this arrangement the most competent agents were able to earn from $4 to $6 a day. When traveling through their districts and away from headquarters agents were also allowed, in addition to actual traveling expenses, a per diem of $4 to cover subsistence.

The commencement of the manufactures canvass was delayed somewhat by the necessity of utilizing the services of the trained manufactures employees on work in connection with the population canvass, and as a result it was not possible to get the field work well under way until after February 1. Another cause of delay was the refusal of many of the applicants for employment as special agents to accept the appointments tendered them—in many cases on the ground of too little compensation or too great an amount of work involved—and still further delay in the progress of the canvass has been occasioned by the resignation of 165 of the local agents before they had completed their work, necessitating the appointment or transfer of others to take their places.

Despite these hindrances the canvass has progressed in a satisfactory manner and is now practically complete. On June 30 the field force numbered 1,158 clerks and special agents, comprising 1,033 engaged in collecting data or instructing local agents and 125 employed on work in the offices of chief special agents in the large cities. At the close of the fiscal year 325,731 schedules had been secured in continental United States, representing 301,954 manufacturing establishments and 23,777 mines and quarries. Of this number 131,678 were received by mail directly from the establishments, 169,188 were secured by special agents and detailed clerks, and 24,865 by enumerators.

COOPERATION WITH COMMERCIAL AND INDUSTRIAL ORGANIZATIONS.

Through the efforts of the census officials the Bureau has received at this census the hearty cooperation not only of other bureaus and agents of the Government but also of chambers of commerce, boards of trade, industrial associations, manufacturers, and statistical experts throughout the country. The spirit of sympathy and cooperation thus cultivated in these organizations was helpful in the preparation of the manufactures schedules and has greatly facilitated the collection of the reports from the individual manufacturers.

GENERAL ORGANIZATION OF OFFICE FORCE.

Provision for the organization of the office work of the Fourteenth Decennial Census is made in section 7 of the census act, which specifies that the appointments of the temporary employees during the Fourteenth Census period shall be made through examinations held by the United States Civil Service Commission, or from the reemployment registers established by Executive order of November 29, 1918, or by transfer from other branches of the departmental classified service of persons who have had previous experience in census work. Provision is also made for the employment, without examination, for not exceeding six months, of persons who have had previous experience in operating mechanical appliances in census work.

In accordance with this provision of the census act, the Civil Service Commission, at the request of the Bureau, held first-grade clerical examinations throughout the country on October 18 and November 15, 1919, and on May 22, 1920, and second-grade clerical examinations for the purpose of establishing eligible registers for the position of card-punching-machine operatives on October 22, November 19, and December 10, 1919. As these examinations did not yield a sufficient number of eligibles, it was necessary for the commission to hold additional first-grade, second-grade, and third-grade examinations for the purpose of establishing supplemental registers for clerks and operatives.

The examinations were similar in scope to the clerk and minor clerk examinations usually held for the departmental service at large; but because the number of inexperienced applicants for clerical and operative positions obtained from the first examination was so large, the Bureau, with the approval of the Civil Service Commission, amended the later examinations so as to require three months' clerical experience as a condition for the admission of applicants to the tests. Age limits were found to be necessary in the interest of good administration and were fixed at 18 to 49 years, inclusive, in

the case of clerks and subclerical employees, and 18 to 44 years, inclusive (later reduced to 35 years), in the case of operatives.

A few appointments were made by the transfer of former census employees from other departments and by temporary appointments, not to exceed six months in duration, of former employees who had operated mechanical appliances at previous censuses.

A large number of appointments were made from the reemployment registers, which consist of the names of employees released from the several departments on account of reduction of force.

The Bureau's statutory force at the beginning of the decennial census period, July 1, 1919, numbered 609. At the close of the fiscal year ended June 30, 1920, the total force in Washington, D. C. (exclusive of 329 special agents who were paid on a per diem basis, and 324 persons employed on the four-hour night force), had reached 5,502. During the fiscal year approximately 7,100 appointments of clerks, operatives, and subclerical employees were made, and 1,805 separations took place. In addition to these appointments, positions were tendered to 4,299 eligibles, 598 of whom declined, and the balance, 3,701, failed to respond or report for duty.

In order to keep the census work under way as rapidly as has been deemed desirable, a night force of operatives has been employed. This force is made up of persons appointed in the usual manner, through examination, who work from 4 to 11.30 each afternoon and evening. In addition, a four-hour force, working from 6 to 10 p. m., composed of persons employed during the day in other Government departments, was organized. This four-hour force, however, has been practically disbanded, as it was found that the "turnover" was so great as to prevent satisfactory results. Of the 828 persons who were appointed on it during May and June, 501 resigned or had been dropped from the rolls by June 30.

In order to stabilize the force it has been necessary to give relatively frequent promotions to employees who entered the service at $900 and $960 per annum, and whose services have been satisfactory. These promotions range from $60 to $180 per annum, the majority being at the rate of $60 per annum, and are based on the relative efficiency of the employees and the nature of the work upon which they are engaged. An effort has been made to adjust the rates of pay for clerks so that employees engaged on similar work in the various divisions shall receive like compensation. The pay of the operatives, which ranges from $900 to $1,380 per annum, has been readjusted semimonthly in accordance with scales of wages based upon the number of cards punched. This class of employees also receives the $240 bonus.

OFFICE WORK ON POPULATION CENSUS.

The office work on the population census consists, in brief, of the following steps: (1) The count of the population direct from the schedules returned by the enumerators, as the result of which the populations of the various cities, counties, county subdivisions, States, and ultimately of the United States as a whole, are announced; (2) such editing of the schedules as is necessary to prepare them for the punching-machine operators, particularly with reference to mother tongue and occupations; (3) the punching of a card for each person enumerated, indicating all the facts ascertained by the enumerator, this punching being done by means of a mechanical device; (4) the comparing of the punched cards with the original schedules so far as may be found necessary for the purpose of verification; (5) the further verification of the punching work by running the cards through two sets of electrical machines, which reject all incompletely or imperfectly punched cards, all cards on which apparently inconsistent items of information are indicated, and also certain other classes of cards for purposes of verification and completion; (6) the sorting of the cards by means of electric machines into main groups—for example, by color or race, nativity, parentage, age, occupation—several different sortings being required at the various stages of the work; (7) tabulation of the facts indicated on the cards in regard to the characteristics of the population by means of electric machines, it being necessary to run the cards through the machines several times in order to record all the facts indicated on them; (8) the assembling and publication of the results of the tabulations.

TEST OF PUNCHING MACHINES.

The electric punching machines used at the census of 1910 were found unsatisfactory in some respects, the chief difficulty being their liability to get out of order. Before deciding upon the type of machine to be used at the present census a test was made of five machines, namely, an old-style pantograph punch; a pantograph punch equipped with a device to prevent double punching, which was invented in the mechanical laboratory of the Census Bureau; an electric punch, such as was used at the census of 1910, in which certain defects of construction had been remedied at the Bureau of Standards; and two machines submitted by one of the commercial concerns manufacturing tabulating equipment. As the result of this test the Bureau adopted the improved pantograph punch for use on population work.

TABULATING MACHINES.

At the Thirteenth Census the Bureau used 96 semiautomatic tabulating machines (fed by hand), with an average output of 15,000 cards a day each. The Bureau has had constructed in its own mechanical laboratory 31 automatic tabulating machines (self-feeding) for use in tabulating the population statistics of the Fourteenth Census. Each of these machines is capable of handling 500 cards a minute, records from 1 to 60 different statistical items, and automatically prints the results on a sheet of paper. One of these machines in use in the division of vital statistics of the Census Bureau recently tabulated 207,221 cards in a seven-hour day at the rate of 29,603 cards an hour, or 493 a minute.

SORTING MACHINES.

At the Thirteenth Census the Bureau used 17 sorting machines, with an average daily output of 75,000 cards each. Twenty-three sorting machines have been constructed or rebuilt in the mechanical laboratory of the Bureau for use in the population division during the Fourteenth Census. These machines have an average daily output of 100,000 cards each, which exceeds by 33⅓ per cent the output of the machines used at the Thirteenth Census.

ORGANIZATION OF PUNCHING FORCE.

The organization of the punching force was begun on February 2, 1920; but it was not until the latter part of February that any considerable number of employees could be assigned to this work. At the end of the month the punching section comprised 89 employees. The actual work of punching was begun on March 1. On May 12 a night force working from 6 to 10 p. m. was organized, and on June 9 a second night force, working from 4 to 11.30 p. m., was organized. The total number of cards punched up to June 30, inclusive, was 39,109,890, of which number 19,234,889, or nearly half, were punched in June. At the end of July the punching was proceeding at the rate of fully 1,000,000 cards a day. The punching of the general population cards, including those for the outlying possessions, numbering over 107,000,000, was completed by October 30.

The machine verification of the cards was begun in a preliminary way on April 1, but the actual work of verification did not start until April 17. At the close of the fiscal year 26,609,304 had been handled by the first set of machines and 25,880,344 by the second set.

After the cards have been passed through the verification machines the rejected ones must be examined and corrected, if necessary. This work was begun on April 30, and at the close of the fiscal year 926,537 had thus been hand verified.

ANNOUNCEMENTS OF POPULATION.

The first announcement of population—that for Washington, D. C., and Cincinnati, Ohio—was given out on February 21, 51 days after the census date and 50 days after the date on which the work actually began. The first announcement in 1910 was issued 69 days after the census date. Announcements of population have been made for all States, counties, cities, and other civil divisions. The total population of continental United States as announced October 7 is 105,683,108. These figures are preliminary and subject to correction, but the final official population, as transmitted to Congress in December for apportionment purposes, is not likely to be greatly different, although it may be slightly larger through the addition of population for small sections of territory claimed not to have been properly canvassed by the census enumerators in January and which are now being investigated.

Printed bulletins, giving distribution of the population according to minor civil divisions, have been issued for several States and the District of Columbia and for American Samoa, Hawaii, and Porto Rico. Similar bulletins for each State and Territory are being issued as fast as the population figures, already announced, can be assembled.

OFFICE WORK ON AGRICULTURE, INCLUDING IRRIGATION AND DRAINAGE.

AGRICULTURE.

At the present census a card-punching system of tabulation has been substituted for the adding-machine system employed at the census of 1910 for the agricultural work. The machines as well as the cards used are entirely different from those used by the population division in its tabulation work. The punching machines used were purchased, and the tabulating and sorting machines were leased. By June 30, 1920, 487 punching machines, 47 punch verifiers, 56 tabulating machines, 3 card-counting tabulators, 69 sorting machines, and 16 gang punches were in operation in the division of agriculture.

The first consignment of agricultural schedules reached the office from the field on January 16, 1920, and the preliminary examination and editing were commenced immediately. By June 30 practically all of the editing had been completed. The total number of farm schedules received at the end of the fiscal year was 6,418,087, and in addition 83,185 schedules, covering 1,771,091 inclosures for live stock not on farms or ranges, were received. At the close of June 40,567,108 cards had been punched, and the successive runs of the cards through the sorting and tabulating machines represented the equiva-

lent of one sorting of 67,590,029 cards and one tabulation of the data on 48,826,456 cards. The average number of cards punched for each farm is about 25.

The agricultural work reached its peak about June 15, at which time there were 1,539 employees in the office and 39 special agents in the field. Since that time a number of employees have been transferred to other branches of the census work.

PUBLICATION OF AGRICULTURAL STATISTICS.

The first publication of agricultural statistics resulting from this census has been by means of press announcements giving certain basic statistics for various counties of the United States. These press statements have been released at the rate of two or more daily since June 1. Complete reports for individual States will be prepared for publication in bulletin form. These bulletins are being issued as rapidly as the data relating to agriculture in the several States can be compiled.

IRRIGATION AND DRAINAGE.

As already explained, the irrigation and drainage inquiries, although forming a part of the census of agriculture, were conducted almost independently of it. By June 30, 1920, about 85 per cent of the irrigation enterprises of the country and about 40 per cent of the drainage enterprises had been canvassed, and the numbers of schedules which had been received for these two classes of enterprises were 51,707 and 12,639, respectively. All schedules received for both irrigation and drainage had been given a preliminary examination and about 30,000 irrigation schedules had been edited before the close of the fiscal year.

OFFICE WORK ON MANUFACTURES, MINES AND QUARRIES, AND FORESTRY AND FOREST PRODUCTS.

At this census the use of long-carriage typewriters for tabulating the manufactures statistics has been discontinued, and there will be employed instead a system of mechanical tabulation whereby the information on the schedules will be transferred to punch cards. It is believed that this method will effect a considerable saving in time and expense in the tabulation of the manufactures statistics.

PREPARATION OF SCHEDULES.

The preliminary work included the preparation of 136 schedules. For manufactures and forestry and forest products there were formulated a general schedule applicable to all industries, an administrative

and general office schedule to be used in securing reports from establishments operated under central ownership, 86 special schedules for selected industries, and a form upon which to report the by-products of all establishments. In addition to these, 2 supplemental schedules were prepared pertaining to the activities of State and city governments in providing for separate forestry departments or bureaus. For mines and quarries and petroleum and natural-gas wells there were formulated a general schedule and 44 special schedules covering the individual branches of those inquiries.

The general schedule, in tentative form, was submitted to the National Association of Manufacturers and other organizations for suggestions regarding its preparation; and, likewise, the various supplemental schedules in process of formation were submitted to the leading industrial organizations and individual manufacturers for criticism and suggestions. In this way valuable information was obtained as to the nature of the data that would be most beneficial to manufacturing industries.

A card index was prepared, containing the names, addresses, and character of products of all establishments—so far as their names could be secured from a variety of sources—from which the reports were to be secured. This card index, after the elimination of duplicates and of the names of establishments found, upon inquiry made through circulars, to be no longer in operation, or at least not to come within the scope of the census, constituted a list of approximately 585,000 establishments to be canvassed.

INDUSTRIAL ZONES.

A feature of the census of manufactures for 1920 will be the presentation of statistics for the larger manufacturing districts by industrial zones. This method of presentation was employed at former censuses for 15 metropolitan districts having populations of 500,000 or over; but because of the increasing demand for statistics along this line the Bureau at the present census has extended the zone method to about 70 districts having 100,000 population and over or manufactured products valued at $100,000,000 or more per annum. An industrial zone for the purposes of this supplemental survey comprises the area within the corporate limits of an important manufacturing city, or group of contiguous municipalities, together with the suburban area industrially tributary thereto. In some cases the county is taken as the zone unit.

OFFICE WORK.

At the close of the fiscal year 308,564 of the 325,731 schedules then received had undergone a preliminary examination in the office. Of this number 216,314 were accepted as complete or capable of being

perfected by correspondence with the establishments represented; 60,383 were found to be so defective as to necessitate their return to the field agents for correction; and 31,867 (the greater number of which had been secured by mail) were classed as "omits," or not coming within the scope of this census.

Work incident to the preparation of the statistics was also well under way at that time; 52,807 schedules had been classified by being assigned to generic groups of industries according to the values of their chief products, and 23,059 had been edited and prepared for tabulation.

ANNUAL AND OTHER INQUIRIES INDEPENDENT OF DECENNIAL CENSUS.

During the year the Bureau carried on its usual annual collections of birth and death statistics, financial statistics of States and cities, monthly and semimonthly cotton and cottonseed statistics, quarterly tobacco-stock statistics, quarterly statistics of fats and oils, monthly statistics of active and idle wool machinery, and quarterly statistics of leather stocks and manufactured leather goods.

BIRTHS AND DEATHS.

The birth and death statistics are collected from areas in which the registration has been found, upon test, to be adequate for the purposes of the Bureau. In general, it is believed that the registration in all parts of the birth and death registration areas is at least 90 per cent complete, and in some parts of these areas it represents a considerably closer approach to completeness. The birth registration area now comprises 23 States and the District of Columbia, the population of which is estimated to form about 58 per cent of the total for the country; and the death registration area is made up of 33 States, the District of Columbia, and 19 cities in non-registration States, and is estimated to contain 80 per cent of the total population of the country.

A special bulletin on deaths from influenza during the pandemic of 1918 was issued for the States of Indiana and Kansas and the city of Philadelphia, the expenses being met by funds supplied by the Public Health Service.

STATE AND MUNICIPAL FINANCIAL STATISTICS.

The Bureau annually collects financial statistics from all cities having populations of over 30,000 and from the several States. These statistics relate to revenues, expenditures, value of municipal properties, indebtedness, and taxation.

COTTON AND COTTON SEED.

Periodical canvasses are made during the ginning season to ascertain the quantities of cotton ginned; and monthly inquiries are conducted to secure data as to the consumption, imports, exports, and stocks of cotton, and as to the supply and distribution of cotton seed and cottonseed products. The statistics appearing in the periodical reports are assembled in annual bulletins.

LEAF-TOBACCO STOCKS.

At intervals of three months canvasses are made to secure data as to the quantities of leaf tobacco held by certain classes of manufacturers and dealers. The statistics based upon the results of these canvasses relate to January 1, April 1, July 1, and October 1 of each year.

The work on these various inquiries has been continued during the census period, but the publication of the reports on them has been somewhat delayed by the necessity of devoting the energies of the Bureau mainly to the decennial-census work.

OTHER INQUIRIES.

In addition to the foregoing, the Bureau conducts the following inquiries having no relation to the decennial-census work:

Fats and oils used for foodstuffs (quarterly).

Active and idle wool machinery (monthly).

Leather stocks and manufactures of leather goods[1] (quarterly).

QUARTERS.

The question of securing additional space for the housing of the Fourteenth Census force was taken up in the early part of November, 1918, and Building D, one of the temporary war buildings, at Four-and-a-half Street and Missouri Avenue NW., containing 237,000 net square feet of floor space, was assigned to the Bureau of the Census. On July 1, 1919, one-half of the building was turned over for use of the Bureau, and on July 1 and 2 the divisions of population and agriculture, on August 12 the geographer's division, and on November 4 the division of cotton and tobacco were removed from the Commerce Building to Building D. In January, 1920, the entire building, except approximately 1,800 square feet occupied by the Congressional Joint Commission on Reclassification of Salaries, was turned over to the Bureau of the Census. On February 17 the administrative division, on March 17 the division of revision and re-

[1] During the next fiscal year (1921) the Bureau will collect monthly statistics of stocks of hides, skins, and leather; quantities of hides and skins disposed of and in process of tanning or manufacture; and quantities of leather produced.

sults, and on May 5 the division of statistics of cities were also removed to Building D. The division of vital statistics, a section of the geographer's division, and the division of manufactures—the office force of which last-mentioned division has been greatly expanded during the census period—are still housed in the Commerce Building.

ESTIMATES AND APPROPRIATIONS.

The estimate originally made for taking the Fourteenth Decennial Census and carrying on the annual and other investigations of the Bureau for the three-year census period ending June 30, 1922, was $20,500,000. After the estimates were prepared provision for an additional inquiry relating to encumbrances on homes was inserted in the census bill by the Senate. It is estimated that this inquiry will add approximately $1,000,000 to the cost of taking the Fourteenth Census, which would bring the estimate to $21,500,000. However, as a result of the assignment of one of the temporary war buildings to the Bureau without rental charge, and of other adjustments, economies were effected which reduced the estimate to $21,215,000. This estimate was made in the expectation that prices and wages would have made some progress toward a return to a normal level before it became necessary to purchase supplies and engage enumerators and other employees in the field and in Washington, D. C., but that expectation has not been realized.

Acting under the authority contained in the Fourteenth Census act, the Director of the Census established the rates of pay of enumerators, basing the rates upon the amount paid for similar work at the census of 1910 and making allowance for a moderate increase. The supervisors were advised of the rates of pay established, and there was a general protest throughout the country against their insufficiency. In deference to this protest an increase was granted, but the supervisors were still unable to secure a full quota of enumerators. In order that there should be no delay in beginning the enumeration, it then became necessary to authorize the payment to practically all enumerators of the maximum rates of compensation permitted by the law. As a result the Department was obliged to submit a deficiency estimate of $2,550,000 for the fiscal year 1920, making the revised estimates for the Fourteenth Decennial Census period $23,765,000, of which amount $21,394,000 was to cover the cost of the decennial census inquiries and $2,371,000 the cost of the annual and other nondecennial work to be done during the three-year census period (July 1, 1919, to June 30, 1922).

To meet the cost of the Fourteenth Census and other work to be performed during the three-year census period, Congress has thus

far made the following appropriations: $15,000,000 in the legislative, executive, and judicial appropriation act approved March 1, 1919; $2,550,000 in the urgent deficiency act approved March 16, 1920; and $5,000,000 in the legislative, executive, and judicial appropriation act approved May 29, 1920; a total of $22,550,000. These appropriations, which continue available until June 30, 1922, are $1,215,000 less than the Bureau's estimates.

BUREAU OF FOREIGN AND DOMESTIC COMMERCE.

The basic problem of the Bureau of Foreign and Domestic Commerce during the fiscal year 1920 has been that of adjusting its efforts to the rapidly changing phases of a transition period. It has been constantly alert and adaptable, striving to enable Americans to take immediate advantage of economic opportunities or, on the other hand, to refrain from injudicious action. Uncertainty and relative instability have been the salient characteristics of the world's economic life since the termination of the war with Germany; and this condition has made the work of the Bureau exceptionally important. Never has there been such an acute need on the part of our manufacturers and exporters for specific data that would make it possible for them to prosecute their export trade with confidence and discrimination, on a basis of sound knowledge. The creation of new States, the erection of new tariff barriers, the commercial realignments, the industrial reconstruction, the perplexing questions of finance—all these factors have contributed to the urgent demand for such service as has been rendered by the Bureau's representatives abroad and its offices in this country.

In ascertaining facts and promptly reporting them for the benefit of American business, it is felt that commendable diligence has been displayed by the field investigators of the Bureau. In most of the great markets of the world they have been present—studying daily developments, judging tendencies, supplying information, defending American interests, promoting American enterprises, smoothing out difficulties, and removing obstacles wherever they appeared. Working in close cooperation with them has been the Bureau organization in the United States, disseminating not only the facts gathered abroad but also the great amount of other data available at Washington.

Thus the Bureau's activity has operated to bring about a greater foreign commerce for this country, conducted with a more assured facility and building on secure foundations the structure of our future trade.

NEW HIGH MARKS ESTABLISHED IN FOREIGN COMMERCE OF NATION.

Unprecedented totals were attained in American foreign trade during the fiscal year 1920. The merchandise that passed through

our ports, in both directions, was valued at $13,349,661,401, exceeding by more than $3,000,000,000 the highest previous figure, which was recorded in 1919.

Imports of merchandise totaled $5,238,621,668, as compared with $3,095,720,068 in 1919 and $2,945,655,403 in 1918. Domestic exports amounted to $7,950,429,180, as against $7,081,461,938 in 1919 and $5,838,652,057 in 1918. Thus the goods sold by the United States to the nations of the world were valued in 1920 at nearly $900,000,000 more than in the preceding year. But because of the fact that we bought much more from other countries, the visible balance of trade in favor of the United States on merchandise transactions (not considering reexports of foreign goods) was $2,711,807,512, as compared with $3,978,134,947 during 1919.

The exports of domestic and foreign merchandise to the several grand divisions during the fiscal year 1920 were as follows: Europe, $4,864,155,166; North America, $1,635,813,316; South America, $490,944,179; Asia, $798,136,458; Oceania, $193,235,039; Africa, $128,755,575; making a total of $8,111,039,733.

American sales to France and Italy decreased appreciably; our shipments to the United Kingdom remained practically stationary; but, on the other hand, Germany purchased from this country $202,176,079 worth of goods, as against $8,818,882 in the fiscal year 1919.

With the exception of Chile, there were substantial increases in American sales to the important South American countries.

The gain in exports to China amounted to more than $35,000,000 as compared with 1919. Since 1918 sales to the Oriental Republic have nearly tripled.

SPECIFIC RESULTS ATTRIBUTABLE TO BUREAU'S ACTIVITIES.

It is possible to mention only a fraction of the cases that have come to the Bureau's attention in which noteworthy sales abroad may justly be attributed—in large measure, at least—to the service that it provides.

The commercial attachés at Buenos Aires and London helped an American pipe and foundry company to obtain a contract amounting to $3,500,000 from the Argentine Obras Sanitarias de la Nación.

With the advice and suggestion of the commercial attaché at Rome, a plan was elaborated which enabled the representative of an Illinois firm to sign a contract for the sale of $200,000 worth of telephone equipment to the Italian Government, with the option of doubling the contract if the home office approved. The same representative states that the attaché at Buenos Aires secured information for him that enabled his company to put through a deal of $100,000 in South America.

As the result of the efforts of the Buenos Aires office in behalf of an American company, its representative was enabled to obtain an order for $100,000 worth of automobile tires.

From Buenos Aires also comes the report that, in consequence of the attaché's conference with two members of the Argentine Cabinet, an American firm was awarded contracts for 35 locomotives, at a price of $1,487,500.

One result of a visit to Uruguay by a commercial attaché was a request from the Government of that Republic for bids from American producers for construction materials amounting to about $500,000.

Through the assistance of the commercial-attaché office at Rome the Società Anglo-Romana bought $200,000 worth of American coal.

A man who sold $370,000 worth of paints and linseed oil on the west coast of South America says: "We are especially indebted to the great assistance rendered to us by the Bureau of Foreign and Domestic Commerce through its commercial-attaché service; we believe our success mainly due to the preliminary work which this department has done in preparing the market for American merchandise."

One New England firm which was induced to enter the China field by the representations of the Bureau and was subsequently given substantial help by the office in Peking has already sold machinery for 15 cotton mills and expects to equip 50 to 100 more such mills.

A company exporting evaporated vegetables and fruits states that more than 40 per cent of its export business has been due to information furnished through the Bureau's district office at San Francisco.

The trade commissioner at Rome put an Italian purchaser in touch with an American firm, and an order for 10,000 pairs of shoes resulted.

The trade commissioner at Prague helped to secure for an American company an order for $116,000 worth of automobile tires for the Czecho-Slovak Government.

The trade commissioner at Brussels was instrumental in obtaining the release of a large cargo of frozen meat from the United States which had been confiscated by the Belgian authorities. This office also placed Belgian manufacturers' groups in touch with American interests prepared to furnish raw materials and fuel in return for finished products to be sold in export markets, thus paving the way for purchases of supplies in the United States by the Belgian glass, furniture, and other industries.

The trade commissioner at Vienna was of particular assistance to American interests investigating the possibility of extending credits to Austrian manufacturers in return for finished products to be sold in export markets.

Indicating only a few of the many definite results recorded in the Bureau's files as resulting recently from its foreign trade opportunity service, one may mention the establishment of a business whose product is valued at nearly $100,000 per year; the sale in Italy of 2,000 cases of salmon, valued at $14,600; $26,000 worth of business in canned fish transacted in one year; $72,899 worth of street-railway equipment sold in Basel, Switzerland; $6,000 worth of musical instruments sold overseas; 6,000 pairs of shoe counters sold in South Africa; and 10,000 carats of hematite sold to a firm in Habana, Cuba.

In addition to the actual orders obtained by American firms through the Bureau's activity, its representatives abroad have accomplished notable results, in a great many instances, by bringing about modifications or favorable interpretations of foreign trade rules that were hampering American business.

EXPRESSIONS OF OPINION BY PERSONS UTILIZING BUREAU'S SERVICE.

The governor of a great eastern State writes as follows concerning the aid obtained from the Bureau's office in one European capital:

I want to express my personal appreciation of the courtesy and effective service shown to representatives of a corporation of which I am president by Mr. Vladimir A. Geringer, United States trade commissioner at Prague, Czechoslovakia. Our representatives are loud in their praises of his interest and assistance to them.

From an official of one of the largest New York trust companies this statement comes:

I have on more than one occasion come into personal contact with your representatives in the field and have a very high regard for their untiring devotion to the interests of American business. They deserve the fullest possible encouragement and cooperation.

A Philadelphia bank speaks of "the vast amount of benefit which the country has received in the past from the various bureaus of the Department" and adds that "the Bureau of Foreign and Domestic Commerce is a commercial laboratory, invaluable to all concerns interested in developing foreign trade."

The representative of a paper company in Virginia writes:

With the aid of your Bureau I was enabled to expand this company's foreign trade on a great scale.

This from a large company trading with the Orient:

We are very grateful for the assistance given and feel that, in view of the value and helpfulness of your Department, the commercial interests of the United States can be well served by the extension of the scope and activities of the Department of Commerce and by giving it greatly increased authority and facilities.

The president of a car company says:

I can not conceive of any branch of work where more good can be done at the present time than in the expansion of our official commercial bureau.

A music company in New York speaks of Commerce Reports as "indispensable," an electrical concern says that the information furnished it "is very complete and is exactly what we desire," a Syracuse firm refers to "the vast amount of desirable information contained in your letter," the secretary of a Boston export organization mentions "the immense amount of accurate information" available at one of the European offices of the Bureau, while a large grocery firm in Mobile states that data of the character supplied to it are "priceless to American exporters."

The following letter has been received from a New York man of wide experience:

The writer, who has lived in many foreign countries, holding positions similar to the one of export manager, can not help expressing his admiration of the excellent service rendered by the Bureau of Foreign and Domestic Commerce. He has found in no other country an institution which, in all its branches, offers such a thorough and correct source of information.

And testimony of a similar nature comes from foreign business men who have been enabled, through the Bureau, to establish mutually profitable connections with American producers and importers. A firm of Spanish importers acknowledges "the signal success" attained, "the uncommon ability, broad spirit, and keen sense of business" displayed by a trade commissioner. From Australia comes a letter telling of the "great service" done the writer by his introduction to the facilities of the Bureau of Foreign and Domestic Commerce, and saying that it has resulted in his "placing huge orders for American produce."

It may be of interest to reproduce a translation of a German opinion—an excerpt from "Auskunftsbuch für den Handel mit der Turkei," by H. W. Schmidt, published at Leipzig, by B. G. Teubner:

It must be admitted that the splendid organization which obtains in the Bureau of Foreign and Domestic Commerce has managed to profit in every possible manner by the circumstances brought about by the war. Even before the war this Bureau had an information service working marvelously in connection with exportation, navigation, commerce, and industry, compared with which ours in Germany was absolutely nothing—possibly on account of our limited means. During the war they managed to perfect the organization still more and to further America's commerce in a manner as incredible as it was successful.

CHANGES AMONG OFFICERS OF BUREAU—REORGANIZATION EFFECTED.

The resignation of Burwell S. Cutler, as Director of the Bureau of Foreign and Domestic Commerce, took effect July 14, 1919, and

on August 1 Philip B. Kennedy, formerly commercial attaché at London, entered upon the duties of the office. Toward the end of the fiscal year Mr. Kennedy presented his resignation in order to accept an important position with a banking corporation, and Roy S. MacElwee was named to succeed him as Director of the Bureau.

Dr. MacElwee had been First Assistant Director since August 1, 1919, when he succeeded Grosvenor M. Jones. Herman G. Brock filled the position of Second Assistant Director from November 1, 1919, to June 20, 1920, leaving the Bureau then to enter the service of a New York bank. O. P. Hopkins, who had been chief of the editorial division, was designated to take up Mr. Brock's work. On July 1, 1920, C. E. Herring, who had been trade commissioner at Brussels, Belgium, became First Assistant Director.

In November, 1919, George E. McLeod succeeded Daniel E. Casey as chief of the division of district offices, Mr. Casey having resigned to enter private business. In March, 1920, Thomas R. Taylor became chief of the Latin American division, in place of C. A. McQueen, who had been appointed commercial attaché at Santiago, Chile. Griffith Evans was sworn in as chief of the editorial division on June 21, 1920.

In May, 1920, a comprehensive reorganization of the Bureau was carried out, introducing a more logical arrangement, facilitating smoother operation, and strengthening the personnel at vital points. The commercial-attaché division and the division of foreign investigations were consolidated under the title of the foreign-service division. The various divisions or sections having to do with distribution, correspondence, and mails were consolidated in a correspondence and distribution division. The Western European was made a European division, and to it was transferred the work relating to central European countries that had previously been performed either by the trade information or by the research division. There was a regrouping of the functions of the First and Second Assistant Directors, the technical and informational activities being placed, in general, under the First Assistant Director and the administrative functions under the Second Assistant. The results have demonstrated beyond question the advantages of the new organization. Increased efficiency has been evident in all the aspects of the work.

EFFORTS IN CONNECTION WITH PORTS AND TERMINAL FACILITIES.

In addition to innumerable other activities, Dr. MacElwee, the present Director of the Bureau, has devoted special thought and effort to the problem of ports and terminal facilities, particularly on the Atlantic seaboard. There has been a keen realization, among

Bureau officials, that American trade is being very seriously handicapped by the congestion at the port of New York. Careful consideration has been given to measures designed to relieve or permanently remedy the situation. By public addresses and written articles the officials of the Bureau have emphasized the necessity of reconstructing and reorganizing at New York, to the end that the port may be capable of handling its immense volume of ocean freight in a way that will contribute to the growth and free movement, rather than the retardation, of American commerce. Attention has been given to the facilities of the Atlantic ports other than New York and the feasibility of diverting traffic in a manner favorable to them.

GENERAL DEVELOPMENTS IN COMMERCIAL-ATTACHÉ SERVICE.

During the fiscal year 1920 the services rendered by the Bureau's commercial-attaché offices have steadily increased in value and extent. As the work at these posts has become better known to American business men, the demands upon the attachés have grown. These representatives have proved energetic and capable in every phase of economic activity, working always in close cooperation with other agencies of the United States Government abroad.

Several of the attachés spent part of the year in this country, placing at the disposal of American merchants and financiers the information acquired in foreign lands. Julean Arnold returned from Peking in August, 1919, and spent 10 months traveling through practically every State in the Union, making hundreds of addresses, and conferring personally with business men interested in Far Eastern trade. Paul L. Edwards, attaché at The Hague, returned in April and made a rapid tour of the country. Julius E. Philippi, attaché at Rio de Janeiro, was granted leave of absence in May and returned at his own expense; he conferred with Government officials in Washington and with New York business men. In June Commercial Attaché Julius Klein returned to the United States from Argentina, prepared to spend several months in the commercial centers of the East. Edward F. Feely, attaché at Mexico City, was ordered to Washington on account of his health; after a short vacation he visited various cities, conferring with business men and addressing gatherings on the subject of trade possibilities with Mexico. Chauncey D. Snow, attaché at Paris, and Chester Lloyd Jones, attaché at Madrid, returned during the year to present their resignations.

During the fiscal year, 4 out of 11 attachés and 6 out of 19 clerks resigned. Two attachés, 10 general trade commissioners, and 11 clerks were appointed.

The new offices opened were at Mexico City, Santiago (Chile), and Berlin.

WORK OF ATTACHÉS IN EUROPEAN COUNTRIES.

The post of commercial attaché at London was vacant during the first seven months of the fiscal year; during this time Herman G. Brock, and later Henry F. Grady, were in charge as "acting commercial attachés." Lincoln Hutchinson, formerly attaché at Rio, reentered the service and was assigned to London as commercial attaché, assuming his duties on February 1. During the year conditions in the United Kingdom began to return to normal. The principal function of the London office was the gathering of general commercial and economic data and the preparing of reports for publication. The work of investigation was divided into three sections corresponding to the most important industries of the Kingdom. Mr. Hutchinson took for his field finance and British Empire economic developments. Trade Commissioner Wilbur J. Page has been investigating the iron and steel industry. Trade Commissioner Leonard B. Gary has followed developments in the textile industry. The association with the embassy has been very close; there is a constant interchange of information, as well as frequent calls on the attachés by the embassy for assistance or cooperation in specific matters. During the year four questions of prime importance have been under consideration by the embassy: (1) Control of petroleum supply in the Near East; (2) the opening of trade with Russia; (3) India's treatment of export hides; (4) imperial customs tariff preference. In all these the attaché has been called upon for information and suggestions. Moreover, he has submitted to the embassy a weekly report on economic developments in the United Kingdom. In addition to attending the monthly meetings of the American Chamber of Commerce in London, he attended the meetings in Paris in June for the organization of an international chamber of commerce, as well as the meetings in London of the International Association for the Exploration of the Sea. Information has been supplied to many American business men calling at the office.

Commercial Attaché Chauncey D. Snow was in charge of the Paris office from July, 1919, till February, 1920, when he returned to the United States and presented his resignation. He was succeeded by William C. Huntington, formerly attaché at Petrograd. Throughout the year Trade Commissioner John F. Adams has been making general investigations in France, and for several months Trade Commissioner Howard W. Adams was attached to the staff of the commercial attaché. The efforts of French officials to prevent further depreciation of the franc resulted in extensive and ever-increasing restrictions upon imports from the United States. The attaché and his staff have closely followed this situation, as well as the general reconstruction of French industry, and have forwarded innumerable

reports upon conditions. They have reported by cable the tariff changes and alterations in import and export restrictions. The office of the commercial attaché at Paris is becoming well known to American business men, who are calling there for varied information. In addition to the usual assistance to the embassy, the office has prepared a weekly report on economic developments in France, which has been cabled to the State Department.

Throughout the year Commercial Attaché Alfred P. Dennis has been in charge at Rome, where Trade Commissioner Henry C. MacLean has also been stationed. The course of Italian exchange has been progressively unfavorable to the purchasers of American manufactured goods. Our foodstuffs and raw cotton have been purchased in enormous quantities by the Italian Government, but the market for miscellaneous goods has shown a tendency to contract. Early in the year, under a régime of close import restrictions, the commercial attaché succeeded in obtaining from the Italian Ministry of Finance special import permits for American goods whose value ran into impressive figures. He conducted an energetic campaign to secure equality of treatment for American merchandise in point of import regulations, and on October 31 all discrimination affecting the admission of American goods was abolished. Since that time our shoes, agricultural implements, machine tools, iron and steel, automobile chassis, rubber goods, leather, and a great variety of other articles have been freely imported into Italy, subject only to the ordinary customs regulations.

At the instance of important American petroleum companies the commercial attaché petitioned the Ministries of Commerce and of Finance for a reduction of the onerous customs and consumption taxes on heavy mineral oils. After four months of effort a ministerial decree was issued abolishing the consumption tax entirely and reducing the customs duty to a nominal figure; the change represented a reduction from 240 lire to 11 lire per metric ton in the Italian taxes on fuel oil. The attaché's office has been busy making trade investigations and forwarding reports to the Bureau at Washington. In addition to the regular weekly reports for the home office and for the ambassador, more than 400 special reports were prepared by the office during the fiscal year. Moreover, numerous reports were prepared for business men who called upon the attaché personally or made their requests through correspondence.

Commercial Attaché Chester Lloyd Jones was in charge at Madrid, and his office reports substantial achievements. It has provided constant aid for American business. Twenty comprehensive studies have been prepared, covering the principal industries of Spain, in addition to many short reports and weekly trade notes. Tariff changes and import and export restrictions have been reported by cable. Special

inquiries from American firms have been answered in detail. The attaché has been called upon continually to furnish information for the consular officers, Shipping Board representatives, naval and military attachés, and the liquidation committee of the United States Army. An excellent illustration of this type of service rendered by the commercial attaché is the collection of a bill amounting to more than 1,600,000 pesetas for potatoes sold to Spain by the American Army. All matters of a commercial nature are referred by the embassy to the commercial attaché, who takes them up directly with the ministers of the Spanish Government. Much pertinent information was furnished during the year to American commercial travelers visiting Madrid and to American firms contemplating the establishment in Spain of branches or representatives. When the attaché returned to the United States, Trade Commissioner William M. Strachan remained in charge of the office.

Commercial Attaché Norman L. Anderson, who has been in charge of the Copenhagen office throughout the year, has been assisted by Trade Commissioner T. O. Klath. They have aided in adjusting numerous trade disputes growing out of the accumulation of huge imports at Scandinavian ports, the resulting crisis, and the rejection of certain shipments. The office has been especially active in encouraging direct American trade with Scandinavia, to supplant indirect trade through Germany and Great Britain. Efforts to promote American terminal centralization in Scandinavian countries, especially at the Copenhagen free port, have resulted in the establishment of branches in Denmark by several of the largest commercial, industrial, and financial institutions of the United States. Through the efforts of the attaché's office there was formed in Copenhagen during the year an American club, which it is hoped will develop within a short time into an American chamber of commerce. Numerous reports have been prepared upon economic conditions in Scandinavia; these have been published in Commerce Reports or distributed directly to American business firms. A large number of inquiries have been answered. Several American Government organizations have called upon the attaché's office for varied services.

Commercial Attaché Paul L. Edwards, at The Hague, devoted much of his time during July and August, 1919, to the handling and liquidation of War Trade Board and Interallied Trade Committee work. After trade restrictions with Germany were withdrawn in July, it was necessary for his office to notify American business men of the effect of the modifications. The office followed German economic developments during the year, in addition to sending many reports upon Dutch conditions to the Bureau at Washington and to the legation. The attaché made several trips to Paris and two trips into occupied German territory. As already mentioned, he re-

turned to the United States in April. During his absence Trade Commissioner Henry F. Grady took charge of the office at The Hague.

It was not until May, 1920, that the State Department considered it advisable for the Department of Commerce to send a representative into Germany to establish an office. Immediately Trade Commissioner Howard W. Adams, who was making a general investigation in France, was ordered to Berlin. He arrived early in June and immediately began to report upon economic conditions.

RESULTS ATTAINED BY ATTACHÉS IN LATIN AMERICA.

Much was accomplished during the year at the Buenos Aires office. Commercial Attaché Julius Klein was in charge from October to May; before his arrival Trade Commissioner Bernard H. Noll managed the office, while Trade Commissioner G. S. Brady was in charge after the departure of the attaché for the United States. The question of tariff reform was before the Argentine Government throughout the year, and a special effort was made to advise American exporters concerning contemplated changes. Another special problem was the revival of German and other European competition. The study of investment opportunities was an important phase of the work. Numerous opportunities involving several million dollars were communicated to the United States by cable; these included a railway project involving about $50,000,000, the exploitation of petroleum fields, the establishment of paper-pulp mills, the floating of two large provincial loans, and similar projects. Definite action by Americans has already been taken in several of these enterprises. A general report on investment opportunities in Chile and Argentina was transmitted by the attaché for the use of the Pan American Financial Congress.

A number of important subjects involving American commercial interests in Argentina were taken up through informal negotiations with Government offices. Among these were the commercial travelers' treaty, which will greatly facilitate the operations of American salesmen; the removal of obstacles to the laying of an American cable from Buenos Aires to Montevideo; the lifting of the Argentine embargo on sugar exports in favor of shipments to the United States; the favorable consideration by the Argentine State Railways of contracts of sale offered by an American locomotive concern; and the revision of local pure-food legislation so as to remove discrimination against American food imports. The most important services rendered by the attaché's office to American interests in Uruguay included negotiations with the Uruguayan Government with respect to the bidding for the year's yield of sealskins from the Uruguayan

Government herds and the investigation of conditions governing bidding for large public-utility contracts involving American concerns, whose interests the office was able to promote very materially.

The office aided and cooperated with the American Chamber of Commerce in Buenos Aires and the United States Exporters' Association of Argentina. Among the problems thus handled were the proposed exposition of American manufactures to be held in Buenos Aires in March, 1921; the arbitration of many trade disputes; the carrying on of dignified publicity work in behalf of American trade; and an arrangement to send Argentine students to technical schools in the United States.

The Buenos Aires office made first-hand studies of such problems as the sugar industry of Tucuman; road conditions in the vicinity of Rosario and Santa Fe; economic conditions in northwestern Argentina; the cement industry in Azul; and public utilities in the Province of Cordoba. The possibilities of mail-order business throughout the interior of Argentina were also given attention.

The work of Julius E. Philippi, commercial attaché at Rio de Janeiro, during the fiscal year consisted principally in clearing away the difficulties arising from the disturbed conditions following the armistice. Many Brazilian houses found themselves unable to accept the large quantities of goods that had accumulated at New York for exportation to the Republic; the attaché was called in, and many conferences with exporters' agents and with importers were held. The attaché's office made an investigation of the legal requirements for the operation of foreign and domestic corporations. Strenuous efforts were made to secure the annulment of various American trademarks registered by unauthorized persons in Brazil. Several patent matters also engaged the attention of the attaché's office, especially the pirating of elapsed patents for aniline colors and dyes. Representations concerning tariff matters were made to the Brazilian committee in charge of the pending revision. Other legislative matters and Government regulations on which the attaché's office was consulted included the Federal regulations on exports, the new stamp law (providing for increased stamps), and the application of the 5 per cent levy on dividends of foreign as well as native companies. The commercial attaché had the help of Assistant Trade Commissioner R. M. Connell.

The office of the commercial attaché in Mexico City was established in July, 1919, when Edward F. Feely, who for nine months had been making investigations in Mexico as a trade commissioner, was appointed attaché. One of his first opportunities was the call for assistance from American firms whose orders in Mexico had been canceled because of falling prices. Mr. Feely succeeded in having orders amounting to more than $300,000, which had been canceled by Mexi-

can importers, reinstated and confirmed. Throughout the year aid was given by the attaché to salesmen and representatives of American exporters and banks. Several agencies for American products were established as a result of personal representations to importers in Mexico City, one of these instances producing an initial order amounting to $35,000. At all times the attaché maintained the friendliest relations with Mexican Government officials, and for the first time in its history the Mexican mint is now using American die steel, electrolytic copper for coinage purposes, crucibles, etc., the purchase of which was arranged through the office of the commercial attaché. The attaché was called upon by the embassy to report upon numerous commercial problems and to make representations to various departments of the Mexican Government. Important trade disputes and claims were satisfactorily settled by the attaché. The duties on canned fruits were reduced in consequence of a petition prepared at the attaché's office. It was through the attaché that the embassy obtained permission to use the Mexican Government wireless service for the transmission of dispatches during the 10 days following the fall of the Carranza government, when all other means of communication were cut off. From time to time the attaché protested against the confiscation of property of American citizens. When Mr. Feely returned to the United States in June, Trade Commissioner Charles H. Cunningham took charge of the office.

Charles A. McQueen, who had been connected with the Bureau at Washington as chief of the Latin American division, was appointed commercial attaché at Santiago, Chile, and arrived at his post on May 25. Because of Mr. McQueen's intimate knowledge of Bureau policy and methods noteworthy results are expected from the Santiago office.

ACTIVITIES OF ATTACHÉS IN CONNECTION WITH FAR EASTERN MARKETS.

Reference has already been made to the return to the United States of Julean Arnold, commercial attaché at Peking, and his tour of the country. He visited 35 cities. By holding individual conferences and by addressing chambers of commerce, business organizations, and colleges and high schools Mr. Arnold was able to place before Americans interested in Far Eastern trade the salient facts about China. Because of his thorough knowledge of economic conditions in China (the result of his 17 years' residence in that country), his advice has been invaluable to thousands of American firms. During Mr. Arnold's absence the office of the attaché at Peking was managed first by Trade Commissioner Lynn W. Meekins and later by Acting Commercial Attaché C. C. Batchelder. Much valuable work was done. The embassy was advised concerning a very large

variety of commercial matters—some relating to the interests of individuals and others involving general commercial policies. An arrangement was effected with the embassy whereby the commercial attaché's office received all strictly commercial correspondence for information, advice, or action. The office rendered substantial assistance to the American Consular Service and to American chambers of commerce in China, as well as to large numbers of individual American business men and Chinese officials. As an illustration of these services mention may be made of a contract amounting to $15,000 which was concluded as a direct result of the efforts of the commercial attaché's office.

Commercial Attaché James F. Abbott has been in charge of the Tokyo office throughout the fiscal year. Trade Commissioner Joseph G. Weimer assisted him during the first few months of the year, but resigned to return to the United States; he was succeeded by Trade Commissioner Alfonso Johnson. The attaché has prepared a large number of short reports upon economic conditions in Japan, as well as several comprehensive accounts of important Japanese industries. His investigations have taken him to the various islands of the Empire as well as on a month's trip to Formosa. He has devoted much time to American business men visiting Japan and has furnished information to a large number of inquirers. He has been in almost daily conference with embassy officials, rendering every assistance within his power. When the cables to the Far East became congested and the silk market began to rise sharply, the attaché cabled daily a brief description of conditions. This information was relayed to the Bureau's New York district office and posted there for the benefit of interested persons, who were thus saved the trouble and expense involved in sending private cablegrams. A large American silk association expressed its appreciation of this service. During May and June, when depression swept Japan, the attaché regularly cabled reports of conditions.

WORK OF THE TRADE COMMISSIONERS.

After completing his investigation of advertising methods in South America, Trade Commissioner J. W. Sanger immediately prepared for a similar survey in the Far East. He has covered Japan and the Philippine Islands and is now working in China.

Another trade commissioner in China at the end of the fiscal year was W. H. Rastall, who is conducting an investigation of the Far Eastern markets for industrial machinery. He has already completed his studies in Japan, the Philippines, the Dutch East Indies, the Straits Settlements, and India. Hitherto only meager information has been available in America with regard to the subject of Mr. Rastall's survey.

Charles P. Wood, who studied the opportunities for selling industrial machinery in France and Belgium, completed the writing of his report and made several trips to important machinery centers in the United States, giving out the information that he had gathered. A series of articles by Mr. Wood was published in Commerce Reports.

After completing his study of electrical goods in Spain, Philip S. Smith was appointed to conduct an investigation of industrial supplies in South America. He arrived at Buenos Aires in March and is making favorable progress.

Trade Commissioner J. Morgan Clements is continuing his investigation of mineral resources in China. During the year Mr. Clements submitted several valuable reports on coal, iron, and tungsten deposits. He has presented data on certain mineral resources of the great Republic that were previously almost unknown.

The same subject has been covered for Spain by Courtenay DeKalb. The trade commissioner has returned to this country and is working on reports on the mineral resources and mining projects of the Peninsula. His work is now practically finished.

There will soon come from the press a monograph entitled "Hides and Leather in France," representing the first report prepared by Norman L. Hertz in his survey of the leather situation in Europe. At the end of the fiscal year Mr. Hertz had completed his work in the United Kingdom and was about to proceed to the Scandinavian countries. He expects, also, to spend brief periods in the Netherlands, Switzerland, Italy, Greece, and Spain.

A great amount of extremely interesting data was brought back to America by Trade Commissioner Paul Page Whitham upon his return from an investigation of transportation and port development in the Far East. Numerous reports were prepared by Mr. Whitham for immediate distribution, and these, through the Bureau's district offices, were brought to the attention of interested persons. The trade commissioner has visited important commercial centers in the United States, giving illustrated lectures and interviewing business men.

George E. Hooker was appointed to make a study of the American ports and terminal facilities on the Great Lakes and the Gulf of Mexico. He has completed his survey of the Great Lakes and expects to submit his report this fall. He is proceeding to the Texas ports and will make a thorough investigation of harbor facilities and related problems at Galveston and other points, with a view to encouraging shipping to Latin America.

The ports, resources, and industrial and foreign trade possibilities of Tennessee, Louisiana, Alabama, Mississippi, Georgia, Florida, and the Carolinas were investigated during the year by Garrard Harris, who is known to American exporters as the author of

"Central America as an Export Field" and "The West Indies as an Export Field." He gave much valuable advice to the business communities in the South concerning present opportunities in foreign trade and the most effective organizations and methods for handling such commerce.

Frank R. Rutter, formerly commercial attaché at Tokyo, returned to Japan, as a trade commissioner, to carry out a short general study of industrial conditions. Recent developments in the Island Empire give a special significance to the data that he is obtaining.

Trade Commissioner P. L. Bell, after making a comprehensive economic survey of Colombia, returned to this country in October by reason of illness. After completing his Colombian report and holding numerous conferences with American business men, Mr. Bell took ship for Venezuela to make a similar study.

W. L. Schurz made a thorough economic survey of Paraguay and then proceeded to Bolivia to carry out an investigation of the same character.

H. Lawrence Groves returned to the United States after finishing an investigation of the markets for agricultural implements in France and northern Africa. He was subsequently reappointed to conduct a general commercial and economic investigation in Switzerland.

Throughout the year Trade Commissioner C. E. Herring investigated general economic conditions in Belgium, visiting all the commercial centers and reporting upon the industrial recovery of Belgium, and her commercial and financial situation. A particular feature of the work of this office was the adjustment of trade disputes between American exporters and their Belgian customers and efforts to place Belgian industries in touch with American suppliers of raw materials and mechanical equipment. The trade commissioner also cooperated closely with the American Embassy in connection with the anti-American propaganda appearing in certain Belgian newspapers. In December Mr. Herring was ordered to Paris temporarily as a member of the American delegation on the Inter-Allied Committee considering the allocation of German dyestuffs under the peace treaty. Mr. Herring was chosen for appointment as Assistant Director of the Bureau in the spring, and before leaving his post in Brussels inspected the commercial-attaché and trade-commissioner offices of the Bureau in England, France, Holland, Italy, Austria, and Czechoslovakia.

At Prague, the capital of Czechoslovakia, valuable service has been rendered by Vladimir A. Geringer. He aided in the sale of the first American cotton shipped to the new Republic, amounting to 28,000 bales, valued at $6,700,000. He was responsible for the purchase of about 200 American tractors. He was instrumental in helping an American company to regain possession of 27 valuable

machines held by the Czecho-Slovak Government as part of the inheritance from Austria. He also succeeded in having 37 tank cars returned to an American firm. In addition to these and many other instances of assistance to American interests, the trade commissioner kept the Bureau currently informed of commercial and economic developments and submitted numerous articles for publication in Commerce Reports.

William Ford Upson was appointed to represent this Department at Vienna and arrived at his post December 18, establishing an office in the American Mission. He has worked in closest cooperation with the American commissioner and his staff, the American representatives on the Reparations Commission, and other American agencies in Austria. He has submitted a large amount of data.

Excellent results were attained by Trade Commissioner E. G. Mears in his general investigation in Turkey.

Louis E. Van Norman, formerly at Bucharest, arrived in Poland in December. He has supplied much information regarding changing tendencies in finance and trade, not only in Poland but also in the Ukraine, Lithuania, Esthonia, Lettonia, and Russia.

Trade Commissioner John A. Fowler has been conducting a general investigation in the Dutch East Indies and the Straits Settlements, and has submitted a great number of reports. One special report, on advertising conditions, will be used by Trade Commissioner Sanger to complete his Far Eastern monograph. For some time Mr. Fowler has made his headquarters at Singapore.

In Australia Trade Commissioner A. W. Ferrin made effective representations with respect to trade restrictions and tariff measures, assisted in a study of the possibilities for an American bank, and supplied specific data to many American business men. Mr. Ferrin made 35 special reports to the Bureau during the year, including two of exceptional length on the sheep industry and on labor conditions, and in weekly reports and economic items he covered more than 500 separate subjects. To Australian periodicals Mr. Ferrin contributed frequent articles on the foreign-exchange situation, the Webb and Edge laws, and other subjects, misunderstanding of which was seriously hampering American trade. He was also active in effecting friendly settlements of numerous disputes over alleged unsatisfactory shipments.

In South Africa R. A. Lundquist has also found it necessary to devote a good deal of time to the adjustment of complaints. In addition, he submitted material for "South African Markets for American Hardware," prepared a monograph on the market for electrical equipment in the Union, and sent in short reports concerning opportunities for selling American goods or obtaining raw materials. One South African agent whom the trade commissioner put in touch with

American firms has placed orders for nearly $100,000 worth of goods. An attempt has been made to develop the market for American tractors and motor cars, with satisfactory results. The attention of American manufacturers has been called to the very promising market for sugar machinery in Natal.

In November Carlton Jackson took charge of the office at Lima, Peru, which had been closed since August. Several important investigations were undertaken and reports made regarding them. Other services were similar in character to those previously mentioned in connection with other posts.

When, in the Bureau at Washington, the commercial attaché division and the division of foreign investigations were consolidated, Perry J. Stevenson, who had been chief of the former division, was sent to Johannesburg, South Africa, as a general trade commissioner. As the fiscal year closed he was on his way to his post.

DISTRICT AND COOPERATIVE OFFICES.

In the transition period following the end of the war with Germany, the Bureau's district office service has been peculiarly affected by reason of its distinctive characteristic—that of local contact. The branch offices have been besieged with callers and flooded with letters from American business men, requesting information on the greatest variety of commercial subjects.

During the year the district offices wrote 63,700 letters, distributed 406,600 foreign trade opportunites (365,000 from the New York office alone), gave out 72,950 trade lists of foreign importing concerns, received 52,053 foreign and American visitors, and sold $8,335 worth of the publications of the Bureau.

By an arrangement with the State Department, all business visitors from foreign countries are invited to call at the Bureau's district offices. The number of such persons who called at one of the district offices during the last half of the past fiscal year represented an increase of 200 per cent over the previous six months. By cooperation with the Chamber of Commerce of the United States, these men are placed in contact with the various local chambers of commerce, are shown the industrial activities of the cities visited, and are aided in their specific quests, with much resultant benefit to export trade in general.

The commercial attachés and trade commissioners of the Bureau have visited the cities having district offices, both before leaving for abroad and after returning; and, by cooperation with the State Department, similar visits of consuls have been and will be increased in number.

As a result of the peculiar conditions of the postwar period many differences have arisen between foreign importers and American exporters. In numerous instances these complaints are transmitted to the Bureau from the foreign-service representatives and are sent to the district offices for personal investigation and report. As a result of this work, an increasing number of such differences have been amicably adjusted.

As in previous years, the district office managers have frequently addressed gatherings such as those at schools and universities, and, by organizing foreign-trade clubs, teaching foreign-trade classes, and preparing articles for publication, have rendered an invaluable service. Aiding concerns to obtain competent employees has been another feature of their work.

There has been an urgent demand during recent months for the establishment of additional cooperative offices of the Bureau, applications having been received from many cities that are becoming actively interested in oversea trade. The Bureau plans to organize many such branches in the future in cooperation with local commercial bodies.

PROMOTION OF TRADE WITH LATIN AMERICA.

Although handicapped by the need for increased personnel and additional facilities, the Bureau's Latin American division has probably rendered greater service to the American business public during the fiscal year 1920 than during any similar period in the past.

The division makes available for the use of manufacturers, exporters, and financiers the exact commercial data concerning Latin America that are obtainable from all authoritative sources. Copies of all relevant reports submitted by the 250 United States Government representatives in Latin America are forwarded to the division, which utilizes them in the most prompt and effectual way. In a single day the division has often received as many as 20 or 30 long articles on various subjects. Besides handling these official communications, the division clipped and indexed, during the past fiscal year, 151 publications—75 in English, 65 in Spanish, 6 in Portuguese, 4 in French, and 1 in Italian. It accumulated also a large amount of miscellaneous material, including pamphlets, catalogues, guides, statistical publications, and other books. By these means the division's files of pertinent data were very materially amplified and strengthened, and it was enabled to supply more complete and diversified information.

During the year the division answered 6,800 letters of inquiry from business concerns and individuals. During January, when the greatest interest in Latin American trade was shown, the number of replies averaged 168 per week. Many of these necessitated research—often

of the most difficult kind. Sometimes questions of the widest scope were involved, such as the extent of foreign investments in Argentina or the markets throughout Latin America for large classes of commodities. The inquiries covered nearly all conceivable subjects. Much information was supplied to individuals calling in person.

The amount of aid given to other Government offices decreased somewhat during the past year on account of the discontinuance of several of the war organizations. Nevertheless, the Latin American division continued to be called upon daily for certain facts. Among the official and semiofficial organizations that used its facilities most frequently were the Foreign Trade Adviser's office, of the State Department; the military intelligence division of the General Staff, in the War Department; the naval intelligence division; the Bureau of Mines; the Bureau of Plant Industry; the Pan American Union; the Shipping Board; and the Chamber of Commerce of the United States. In some instances employees of these departments and organizations worked several days in the Latin American division in order to complete certain studies on which they were engaged.

During the year the division prepared 15 Latin American circulars, which were published in Commerce Reports. Among them were nine circulars on the automobile markets of the countries to the south of us. These filled 100 pages and, besides giving detailed information on the extent and possibilities of the trade, form a treatise on highway transportation throughout Latin America. The other six circulars were entitled "The Chilean Market for Fuel," "Coconuts from Tropical America," "Peruvian Exchange During the War," "Operations of the Peruvian Corporation," "The Nitrate Industry of Chile," and "The Argentine Fuel Market." Other important articles prepared in the division for Commerce Reports included a 6-page review of the trade of the United States with Latin America during the calendar year 1919 and a 16-page supplement on the trade of Salvador. About 150 pages of additional copy were supplied by material prepared or rewritten in the division from reports of commercial attachés, trade commissioners, and consuls. Two or more pages of trade notes from Latin America are printed each week in Commerce Reports.

During the year the division received replies to several questionnaires sent out through the State Department to the various consulates. These include discussions of the market for gloves, for jams and jellies, and for motion pictures. The division has prepared a number of copies of these replies, which are loaned on request.

The Bureau's old trade lists relating to Latin America have been revised and supplemented, and new lists, which are submitted continually, have been copied for the files.

In many cases the division has acted on its own initiative in bringing important trade information to the attention of American firms that might be interested. Several matters involving the letting of contracts have been placed before American concerns in that way.

During September and October Charles A. McQueen, chief of the division, made a three weeks' trip to Texas, at the request of Senator Morris Sheppard, in an effort to interest Texas manufacturers in the Latin American markets. After his return a large number of letters were written to manufacturers whom he could not reach personally. The effect of this visit, followed up by correspondence, has been noticeable in the number of requests received from Texas manufacturers who have become interested in developing their trade with Latin America and have become familiar with the assistance that the Bureau can offer. Mr. McQueen also made several shorter trips to the eastern and central parts of the country.

EFFECTIVE AID FOR AMERICAN COMMERCE WITH THE ORIENT.

During the fiscal year the Bureau's Far Eastern division emphasized especially the work of answering direct inquiries from manufacturers and exporters. A complete system of clipping, filing, and indexing material of probable interest to such inquirers has been perfected. This includes a collation file of all clippings, memoranda, trade lists, and unpublished material, arranged by commodities and subdivided by countries; a card index of all reports from field officers of the Bureau and from consuls; a card index of all duplicates of replies to commercial inquiries prepared by Bureau investigators and consuls; a card index of all articles on Far Eastern trade that are too long to clip; and a library of the customs returns, the yearbooks, and the various official reports and pamphlets issued from time to time by all countries in the Far East.

During the year the division wrote 5,901 letters regarding trade conditions and related matters—an average of 113 letters per week. Compared with a total correspondence of 2,192 letters during the preceding year, or 42 per week, this is a concrete evidence of a very pronounced interest in the Far East.

On its own initiative the division has distributed much timely material as soon as it was received. There has been effective cooperation along these lines with technical and trade organizations, which have been more than willing to distribute reports that chiefly interested their membership.

Because of the insufficient printing fund available for the Bureau, the Far Eastern division has resorted to the expedient of condensing reports into one-third or one-fourth their original size and issuing them as typewritten circulars, the nature of their contents being

stated in a short paragraph in Commerce Reports. These circulars have given wide distribution to material that would otherwise have been left in the files. One hundred and sixty-six of them were issued during the year.

Many pertinent facts have been presented to the American business public through the medium of the "Far Eastern Trade Notes" and "Review of the Far Eastern Commercial Press," the former appearing three times a week and the latter once a week in Commerce Reports.

The division has continued the practice of preparing special articles for Commerce Reports. Some of those appearing during the year were entitled "Dyestuff trade in the Far East," "Trade conditions in Malaya," "Manila as a distributing center," "The sole agency in Far Eastern markets," and "Achievements of New Zealand Farmers' Cooperatives."

At the beginning of the year it was decided to revise and reissue all the Far Eastern trade lists. Under the new plan, when a report from a consul was about to be published in Commerce Reports, the trade list submitted was sent to the division, and with this as a basis, a new composite list giving all the names of dealers in that commodity for the whole country was prepared. The lists from each consular district which this new list superseded were then recalled. An arrangement has now been made to indicate on these lists the relative size of the concerns by means of stars. During the year 189 of these new lists were issued.

The Far Eastern division continued its activity in behalf of the enactment of a law for Federal incorporation of American companies operating in China. The Bureau's foresight in endeavoring to further this legislation was emphasized when, by the issuance of British Orders in Council, American companies were compelled to withdraw from incorporation under the Hongkong ordinances. The keenest desire for the proposed new law was manifested by China companies and their American representatives. In May, 1920, the Seventh Foreign Trade Council formally recommended the passage of the needed legislation. Congress adjourned on June 5, however, without taking action on the bill that was pending.

In carrying out its policy looking toward the creation at Manila of an entrepôt for American shipping in the Orient, the Bureau detailed to Manila Trade Commissioner P. P. Whitham, who had just completed his studies of ports and terminal facilities in China. Largely through his efforts a bond issue was authorized by the Philippine Legislature for the improvement of Manila port facilities. In his report on "Manila Port Development" Mr. Whitham gives the details of this proposed improvement as well as a more comprehensive scheme

for a free-trade zone. These plans have been received with much enthusiasm by shipping and other interests in the United States.

The persistent propaganda directed against the Webb-Pomerene Act by certain interests in Australia has led the Bureau to take active steps, through Trade Commissioner A. W. Ferrin, to contradict misinterpretations and explain the real purposes of this legislation.

In addition to these special activities, the Far Eastern division has been successful in many ways in promoting commerce in the Far East. By the adjustment of trade complaints, by investigating cable conditions, by encouraging the establishment of a translation bureau at Shanghai, by advocating the growing of tropical products in the Philippines, by aiding in the allocation of an exposition ship to travel in the Orient, by assisting in the establishment of a grading and inspection bureau in the Far East, and in many other ways, the division has kept in close touch with the needs of commerce in the Orient. It is believed that the remarkable interest now manifested in Far Eastern trade is due in part to these activities.

PROGRESS IN WORK RELATING TO RUSSIA.

The American public has evinced keen interest in Russian social and commercial conditions, but much of this interest has in the past been rendered ineffective by reason of conflicting information, unfamiliarity with Russian preferences and practices, and, in general, an imperfect comprehension of the basic economic factors that will determine the course of future trade. If the impulse toward trade with Russia is to represent wisely calculated effort rather than a dissipation of energy, it must be directed into proper channels. Misapprehensions must be dispelled. Definite, dependable facts are peculiarly essential here, and in supplying such facts it is felt that the Bureau's Russian division has been notably successful during the year just past.

The territory covered by the division is that of the former Russian Empire, Finland, and Poland—a consuming market of nearly 200,000,000 people as well as a rich source of raw materials. The United States conducted very little direct trade with Russia before the outbreak of the World War, many American goods that were ultimately destined for that nation being sent through intermediary countries, such as Germany and England. One of the aims of the Bureau's Russian division is to bring about the discontinuance of that practice and to promote direct commercial intercourse with Russia.

The division keeps up a constant interchange of information with various chambers of commerce, the Russian-American Committee

for the Far East, the Russian Economic League, the American Manufacturers' Export Association, the All-Russian Central Union of Consumers' Societies, the United Credit Union of Siberia, the Union of the Siberian Creamery Associations, the leading banks and shipping companies, the representatives in America of Poland, Finland, Russia, Esthonia, Lithuania, and Ukrainia, and the American firms represented abroad, whose foreign agents frequently report matters of interest directly to the division. Bulletins of the American-Russian Chamber of Commerce and the Russian Economic League often contain reprints of articles that have appeared in Commerce Reports. The policy of cooperation undertaken by the division has led it to maintain personal relations with other Government workers dealing with similar subjects.

In answer to inquiries from American business men, the division endeavors to supply extensive data compiled from every available source, and so far as possible to anticipate the needs and interests of the inquirers. Among the subjects taken up during the past year have been: Flax, oil, transfer of remittances to Poland, dealings with the Russian cooperatives, etc. Numerous callers are given careful attention and the full benefit of the division's files and library. Besides those inquiring about strictly business matters the division has furnished information during the past year to American representatives departing for their posts, persons writing books on Russia, persons preparing to deliver addresses on that country, and others desirous of obtaining reliable data.

Among the titles of articles prepared by the division for publication in Commerce Reports may be mentioned "Siberian petroleum shortage and substitute fuels," "Industrial activities of Centrosoyuz," "Paper crisis and new paper enterprise in Siberia," "Big sugar enterprise in Siberia," "Supplies for Siberia via Arctic Ocean," "Port of Archangel, Russia," "Facilities of the port of Odessa," "Kamchatka Peninsula and its fishing industry," "Committee controlling trade at Vladivostok," "Siberian raw materials for export by northern route," "Finnish wood-pulp industry," "The port of Helsingfors," "Polish coal resources," "Facilities of port of Danzig," "Tractors and motor plows in Poland," and "Polish paper industry."

A 55-page handbook on the Caucasus was issued as a supplement to Commerce Reports, and a similar handbook on the Baltic Provinces is in course of preparation. The division prepared during the year a study outline of the commercial area of the former Russian Empire, which was published in Miscellaneous Series No. 97, "Training for Foreign Trade." A list of publications on Russia in the English language was also prepared. Various circulars were sent out, among the most important being one on trade with Soviet Russia and one

on the possibility of sales to the Caucasus through a specific Russian firm; the proposition contained in this latter circular was taken up with great interest by many American concerns.

NEW DIVISIONS ESTABLISHED FOR EUROPE AND NEAR EAST.

In pursuance of the policy of establishing separate geographical divisions to handle the work relating to different regions, there were formed in the Bureau during the past year a Near Eastern section and a European division. All the territory of the world is now definitely assigned to one or another of the special geographical divisions.

The European division is concerned with the United Kingdom and the countries of continental Europe that lie west of Finland, the Baltic States, Poland, and the Balkans—together with the colonies of such countries except those in the Far East or in or near Latin America. It is the outgrowth of a Western European division which was organized in January, 1920; the larger organization dates from the middle of April.

In this division one translator or research clerk is responsible for Norway, Sweden, Denmark, and the Netherlands; another for France and Belgium; a third for Spain, Portugal, Italy, and Switzerland; and a fourth for the British Empire. The assistant chief has been made responsible for Germany, Austria, Hungary, and Czechoslovakia, pending the filling of a vacancy. Each person responsible for a group of countries receives all incoming materials and all service inquiries relating to his particular field.

The European division is building up a file of valuable information; card directories of trade organizations are being compiled; constant scrutiny is maintained over the work of the Bureau's representatives in the European field; special inquiries are being initiated; and many letters are being written in response to requests coming through the mails. The program for the future calls for more attention to the economic backgrounds of the main countries and colonies; a more careful study of imperial and colonial policies; a greater emphasis upon the preparation of trade lists; and even closer relations with the men engaged in foreign service.

At the beginning of the calendar year 1920 a Near Eastern section was created, and at the end of the fiscal year it was given the rank of a division. The field covered includes Rumania, Bulgaria, Jugoslavia, Albania, Greece, Turkey, Arabia, Persia, Egypt, Cyprus, Malta, and the Dodecanese group of islands.

The section has been operating along much the same lines as the other geographical divisions, though the work has been on a somewhat smaller scale thus far. Numerous requests for information were answered during the year, either orally or by letter, and when

it appeared desirable a follow-up system of supplying additional data from time to time was adopted. Helpful conferences were held with officials of other Government departments. Consideration was given to various projects for an exhibition of American goods in Greece. Special questions relative to transportation, the lack of warehousing facilities in Constantinople and other places, the shipping of Egyptian cotton, cable difficulties, and the petroleum field of the Near East occupied the attention of the section to a considerable extent. Complaints of concerns in the Near East against United States companies were placed in the proper channels for investigation.

Increasing interest in the Near East is being manifested by American business men, and the Bureau feels that the new division can be of substantial service in the development of that field.

REORGANIZATION OF CORRESPONDENCE WORK.

The creation of the European and Near Eastern divisions, which took over specialized foreign-market work previously handled by the division of trade information, made it necessary to redefine the scope and responsibilities of the last-named division. Under the new arrangement its name was changed to the division of correspondence and distribution, and it was given charge of the incoming and outgoing mail and the distribution work of the Bureau. Two months' operation under the new plan has proved the wisdom of the reorganization. The centralized supervision over the mail makes possible a uniform, judicious routing of incoming letters and tends to insure consistency, adherence to policy, proper form, and absence of duplication in the outgoing correspondence.

Miscellaneous correspondence answered directly by this division includes requests for lists of American and foreign manufacturers, for Bureau publications, for trade opportunities and other confidential material, for names of importers in the United States, and mixed inquiries on various subjects. During the year just ended about 37,000 outgoing communications were prepared in this division.

Included in this division is the commercial-intelligence section, which is compiling and maintaining, in card-index form, a world trade directory of business houses, to provide American firms with reliable information concerning prospective buyers or agents all over the world. From this directory are compiled commodity trade lists covering a given section of one country, an entire country, or a group of countries. Not only do these new lists show the character of business conducted by each firm—that is, whether wholesale, retail, commission merchant, or agent—but they are also "starred" to indicate the relative size of the firms. Other vital details are furnished con-

cerning the capital, organization, and commercial activity of the foreign houses. The interest in and demand for this service is plainly evident from the number of letters received. It is confidently believed that it will obviate many difficulties and losses. It will be a guide to merchants planning trips; will save useless calls by traveling salesmen; will be of signal service in making discounts; will enable the Bureau to act with discrimination in publishing trade opportunities and adjusting complaints; and will, in general, replace uncertainty with accurate knowledge.

DIVISION OF STATISTICS.

In the last six years American foreign trade has increased threefold, the number of classes in the tables of imports and exports has been augmented by one-third, and the number of inquiries reaching the Bureau's division of statistics has become much larger; but during the same period the personnel of the division has been increased only from 30 to 34 employees. It would appear that additional help is indispensable, if the division is to handle adequately the tasks devolving upon it.

The list of the principal countries shown in the import and export tables of the Monthly Summary for the most important classes was revised in July, 1919, and again in January, 1920. On account of the radical changes during and since the war in the customary trade channels, it is difficult to keep these tables up to date.

The table of "Imported merchandise remaining in warehouse" was changed, beginning with January, to show the withdrawals during the current month by articles. The comparison with the corresponding month of the previous year was discontinued.

All the tables for the annual report on the Foreign Commerce and Navigation of the United States for the calendar year 1919 were completed and in the hands of the printer by June 9, about a month later than last year, when the division utilized the service of six additional clerks employed out of the special fund allotted for statistical work from the appropriation for national security and defense. Tables 3 and 5 of the 1919 report, giving imports and exports by articles and countries, show figures for two calendar years.

In view of the wide interest in the upbuilding of an American merchant marine, the statistics of vessels entered and cleared in the foreign trade, by customs districts, were published in much greater detail than in previous years. Part 2 of Table 12 for 1919 shows the number and net register tonnage of American and foreign vessels entered and cleared at each customs district from and to each foreign country, vessels with cargo being stated separately. This detail is especially useful to the Shipping Board and to shipping concerns

generally, and advance proof sheets for the purpose of special compilations were requested by several parties.

The tables in the foreign-trade chapter of the Statistical Abstract were changed from fiscal-year to calendar-year periods, in conformity with the act approved January 25, 1919, requiring the annual report to cover the calendar instead of the fiscal year.

Special compilations of the imports and exports of the United States in the terminology of the Brussels international statistical classification were prepared for the use of the International High Commission.

A new edition of Trade of the United States With the World, showing imports and exports by articles in the trade with each foreign country during the calendar years 1918 and 1919, is in course of preparation.

The special statistical-service section, organized in January, 1919, compiles special monthly statements showing complete details for the commodities covered, by countries of shipment or destination. Photostat copies of these statements are furnished to trade journals for publication, and to commercial organizations for distribution to their members. The tables range from letter size for single classes to statements of 20 columns for such groups as electrical machinery, rubber manufactures, agricultural machinery, etc. At the present time 85 tables are compiled, of which 1,700 copies are distributed to a mailing list ranging from 12 to 39 addresses for each statement. Requests for the extension of this service are being received constantly, but the Bureau is unable to comply with them on account of the inadequacy of its contingent fund and the need of more clerks. If a nominal charge at actual cost could be collected and the proceeds used for extension, it would be possible to respond to the demand.

Numerous requests have been received from boards of trade and other parties for annual statistics of imports and exports for particular customs districts by articles and countries of shipment or destination; but it is obviously impossible for the Bureau, with its limited appropriation, to compile and publish statistics in such detail.

G. B. Roorbach, special expert of the division of planning and statistics of the United States Shipping Board, who had been in charge of the actual construction of the new import and export classifications, severed his connection with the Government service at the end of August, 1919. The material collected was turned over to the division of statistics of the Bureau of Foreign and Domestic Commerce. A critical examination of the classifications that had been completed showed the necessity of a thorough revision, especially for tariff requirements of the import schedules. Such an examination was made by experts in the New York customhouse, and the preparation

of the uncompleted schedules was undertaken by the division of statistics. It soon became apparent that it would not be possible to have the schedules printed and distributed to American consuls, importers, exporters, and collectors of customs in time to make them effective by January 1, 1920. The compilation of the reports under the new classifications, which provides an increase from 700 classes each in the present import and export schedules to about 1,200 each in the new, would require material increases in the equipment and personnel of the Bureau of Customs Statistics at New York, as well as the Washington office, additional funds for which were not available. Under these circumstances a postponement of the effective date for another year was unavoidable, and notice to that effect was issued through the press and communicated to all who had assisted in the work.

Since then the revision has been completed and the schedules sent to print. In response to the almost unanimous statements by users of the published statistics that, in view of the much higher price levels, values only, without quantities, are of comparatively little use to them, quantities in customary units or in weight will be shown for all items in the new classification.

The question of providing additional clerks for the division of statistics after January 1, 1921, in order to handle the increased work caused by the enlarged classification has occasioned much concern. It is quite impossible to institute the new schedules—an increase from 700 to 1,200 classes—without additional assistance.

A comprehensive plan outlining contemplated improvements in the statistical service was submitted to Congress in a supplemental estimate transmitted through the Secretary of the Treasury on May 7, 1920. It proposes the transfer of the control and expense of operation of the Bureau of Customs Statistics at New York from the Treasury to this Department and authorizes its consolidation with the division of statistics of the Bureau of Foreign and Domestic Commerce into one office located in either New York or Washington, or partly in one place and partly in the other, as may be found most advantageous.

It provides for extension of the statistical classification of imports and exports, enlargement of the personnel and equipment of the new office, and the introduction of more efficient methods for compiling the monthly and annual reports; it also authorizes a charge at actual cost for special statistical statements and the use of the proceeds for extending such special service. A lump-sum appropriation of $400,000 is asked for the purpose of carrying the contemplated improvements into effect. The proposition was considered by the Senate Committee on Appropriations in connection

with the customs appropriation for 1921 carried in the sundry civil bill, but no action was taken on it. The plan has received the indorsement of the Chamber of Commerce of the United States and of the leading commercial organizations and foreign-trade banks.

ORIGINAL RESEARCH AND COMPILATION OF FOREIGN STATISTICS.

The work of the Bureau's research division was, as usual, concerned with statistics of foreign countries, questions relating to foreign investments, banking, and exchange, and such economic problems relating to the trade of the United States as came before the Bureau for action. Several detailed compilations of foreign-import statistics have been prepared during the year. On account of the limited force available for work of this character, it has not always been possible to comply with all requests for statistical information, as the transcribing of figures requires much time; a plan has therefore been worked out whereby photostat copies of the pages containing the figures desired are furnished. The research division has in course of preparation a pamphlet giving the titles and brief descriptions of the principal statistical publications of foreign countries.

FOREIGN INVESTMENT OF AMERICAN CAPITAL.

The research division, within the past year, has given increased attention to the matter of informing those interested in the investment of American capital in foreign fields. One of the outstanding facts in the foreign commerce of the great exporting nations has been the way in which such trade has been enlarged and stimulated by the investment of capital in the countries to which the goods are sold. Enterprises that owe their existence to foreign capital are naturally inclined to purchase equipment and supplies in the land of their financial origin. The attendant industrial expansion increases the consuming capacity of the people. And, again, the willingness of foreign capitalists to aid in the development of a country's resources creates a favorable attitude on the part of that country's citizens and a receptivity toward other business propositions. The Bureau has, therefore, sent out to the chief American investment houses the reports received from commercial attachés, trade commissioners, and consuls bearing on opportunities for investments overseas.

As American bankers have expressed growing interest in fundamental economic conditions in foreign countries that influence exchange and international banking, the Bureau has sent out as special reports, to interested bankers, statements prepared by the foreign representatives of the United States concerning such conditions.

DIVISION OF FOREIGN TARIFFS.

A large amount of work was performed during the year in the Bureau's division of foreign tariffs, in keeping American business men informed concerning war restrictions retained or adopted by the various foreign countries, as well as the numerous changes in foreign tariffs, designed to meet temporary postwar conditions, pending more thorough revision.

Special attention was given to the "coefficient" expedient adopted by France and Belgium for the purpose of maintaining the level of protection, in the face of rising commodity prices, and also to the important movement affecting the tariff and other economic relations of the constituent parts of the British Empire. This latter movement has been greatly accelerated by the war and has been extended in scope so as to include not only preferential reductions in import duties but also concessions in export duties and even exemptions from import prohibitions and export embargoes; a considerable amount of material on the subject has been gathered by the Bureau, and the whole movement is receiving most careful study from the division of foreign tariffs.

The publication work of the division during the year was confined to current notes on tariff matters in Commerce Reports, subsequently republished as Foreign Tariff Notes. It was deemed inadvisable to resume the publication of monographs in the Tariff Series (comprising translations and detailed studies), partly because of the generally unsettled tariff situation and partly on account of the small staff of the division, which is merely sufficient to take care of the current work.

The trade-mark work of the division expanded considerably during the year. The Bureau has unquestionably done a great deal to make the American business public realize the importance of trade-mark registration in foreign countries and has succeeded, through timely warning, in preventing the registration of numerous American trade-marks by unauthorized persons abroad.

Letters written by the division averaged 450 a month. The character of the inquiries changed somewhat from the preceding year, and the subject of trade restrictions is gradually giving place to rates of duty and other more normal phases of the tariff.

EDITORIAL DIVISION.

An unprecedented number of reports was received during the past year in the editorial division of the Bureau as a result of the economic readjustments following the termination of the war. The many striking developments throughout the world have made the

volume of commercial news extremely large. In consular reports alone the increase over the previous year amounted to nearly 6,000. The number of reports and other commercial communications (including trade letters and trade opportunities) submitted by consular officers totaled 22,610, while the reports from the Bureau's own representatives in the foreign field rose to a total of 3,480.

Most of the material was excellent, the reports were handled expeditiously, and in consequence the number of printed pages in Commerce Reports, the daily publication of the Bureau, reached a new high mark. The total was 7,232 pages, an increase over the preceding year of 1,472 pages. There was also a gain of 561 in the number of printed pages of the Supplements to Commerce Reports, containing the annual trade reviews of American consuls. The number of published foreign trade opportunities jumped from 2,703 for the fiscal year 1919 to 3,364 for the past year.

Fifteen monographs were prepared for publication in the Special Agents' Series and 19 in the Miscellaneous Series. In this work, also, the number of pages edited showed an increase over other recent years. In the monograph work, however, difficulty has been experienced by reason of the shortage in the printing appropriation, which has been inadequate to take care of all the reports whose publication seemed advisable. Certain reports that were edited during the third and fourth quarters of the fiscal year were of necessity held until the new appropriation became available on July 1. The lack of sufficient funds delayed or prevented the dissemination of data gathered by a number of field investigators. This is an unfortunate situation, which is likely to recur during the present year, and it is earnestly hoped that in the future more generous provision may be made for this publication work.

Among the noteworthy monographs of the year were the Commercial Travelers' Guide to Latin America, the two volumes of the Commercial Handbook of China, and five books discussing the economic position of important countries from 1913 to 1918.

RECOMMENDATIONS.

1. I recommend the improvement and extension of the commercial attaché service. This service continues to justify the expectations of the American business men who originally recommended its establishment. The satisfaction felt by the business community with the work of the commercial attachés, as expressed graphically in the spring of 1920, when it appeared to them that an effort was being made to have Congress eliminate the service entirely by withholding an appropriation, has left no doubt in my mind as to the worth of the service.

The service is still handicapped by the fact that private business concerns find it possible to pay an experienced commercial attaché or trade commissioner much more than the Bureau can. It is not necessary to meet this competition from business houses on an exactly equal footing, as there are certain considerations that make the commercial attaché's work particularly stimulating and interesting and offset to a certain extent the disparity in pay. But the advantage as a whole lies with the business house, and I am firmly of the belief that it would be worth while for the Government, and for business as well, to make it possible to retain the best attachés in the service for at least four or five years instead of one or two years, as at present.

There is also the urgent necessity of establishing several additional commercial attaché posts. The American exporter, it is my belief, will find it increasingly difficult in the future to maintain his position in many of the foreign markets, and I do not hesitate to say that such assistance as the commercial attaché service can render will be more important and vital to our traders during the next year than it has been at any time during the last five years.

2. I recommend also a considerable increase in the fund known as "Promoting commerce," from which are paid the trade commissioners in Europe, as well as in Australia and South Africa, and the district-office service in the United States. There is a tendency in some quarters to belittle the possibilities of American trade in Europe for some time to come, and while it is true that certain grave obstacles are at present keeping down the total value of sales to that continent, it is equally true that industrial and commercial developments there for some time to come will be of the utmost importance to the future of American trade. The real fact is that these developments are difficult to get at, and the need for intelligent studies by disinterested observers has never been greater than it is now, and will continue to be for the next four or five years. Money invested in this way may not bring immediate returns, but will surely be well spent in the long run.

It is hardly necessary for me to make a case for the need of more and better-equipped district offices. These offices, which serve to vitalize information gathered by the Bureau and to bring it directly to the manufacturer and exporter, are serving a more useful purpose than ever before in our history and have the unconditional support of the business communities which they serve. We have the same difficulty in keeping capable men at work in these offices that we have in our foreign service.

3. I shall ask for an increase of 50 per cent in the appropriations for both the Latin American and the Far Eastern work. The two divisions at Washington that specialize on these districts are acknowl-

edged to be rendering a valuable service. Investigations conducted in the field under their direction should be greatly extended. The 50 per cent increase asked for will, if granted, be used to increase the pay of the men now at work and to extend the service by taking on additional specialists.

4. I am particularly interested in improving the service rendered by the home office at Washington. Here the staff is more strikingly underpaid even than the field staff. The number of positions and the salaries paid have not been increased to keep pace with the development of the field staff, and yet the distribution of the information gathered in the field is practically as important as the field work itself. Any manufacturer will bear witness to the truth of the statement that it is folly to let distribution facilities lag behind production facilities. This truth is particularly applicable to the Bureau of Foreign and Domestic Commerce. We not infrequently spend from $10,000 to $15,000 on a highly desirable investigation of foreign market conditions, only to have the resultant report held up for weeks and sometimes many months because the editorial staff is already swamped with work or because the printing appropriation has already been exhausted. Many well-known American business men have marveled that this condition should be allowed to exist in an organization otherwise highly esteemed for its efficiency and all-around business ability. There are not enough employees in the home office to insure the prompt distribution of our material, and, among the positions we do have, the number of low-salaried clerks, at $900 to $1,400 per annum, is altogether out of proportion to the better-paid positions. My business friends are well aware of the quality of help that can now be obtained at our entrance salaries, and I know they will agree with me when I say that, if the Bureau is not eventually to "go to seed," it will be absolutely necessary to provide an entrance salary sufficiently attractive to draw into the service young men and women of the right sort.

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NATIONAL BUREAU OF STANDARDS.

The technical work of the Bureau of Standards has awakened a keen interest during the year not only on account of the fundamental importance of standardization but as well on the useful results of special researches undertaken at the request of the industries and the Government departments. The scope of the Bureau's work is comprised under the general head of the standards of measurement, standard physical constants, standards of quality, standards of performance, and standards of practice.

The year has been one of unusual activity in the reporting of researches and investigations. The results of these activities are partly shown in the 106 new Bureau publications issued during the fiscal year. With the postwar decrease in purely military investigations and the renewal of industrial research, many lines of investigation deferred during the war have been effectively reorganized and are already producing fruitful results. In this connection, the Bureau has had brought to its attention as never before the importance of industrial research in promoting the economy and efficiency of the industries and in the interests of both foreign and domestic trade. The list of the 106 new publications of the year exhibits a wide range of scientific and technical subjects.

PUBLICATIONS.

The new publications comprise 50 scientific papers giving results of new scientific researches; 37 technologic papers dealing with practical applications of science in industrial fields and engineering; 16 circulars containing important compiled technical data of special use to the industries, especially to the scientific and industrial laboratories; and in addition 3 miscellaneous publications were issued. The Bureau also issues a monthly technical news bulletin for distribution to technical laboratories and experts interested, giving the prompt announcement of progress on researches being conducted at the Bureau and information concerning tests of special interest to the industries.

A work of unusual importance was completed under special provision of Congress providing for the investigation of the methods and instruments for measuring high temperatures used in the indus-

tries. The results have been embodied in a publication which is now in press, entitled "Pyrometric Practice," which is the most complete work on this subject that has yet been prepared. The object of the treatise is to provide investigators, manufacturers, and others concerned with high-temperature measurements complete information on the present state of the art of pyrometry, the instruments and methods used, the precautions to be observed in obtaining correct results, illustrated by selected industrial applications of high-temperature measurements.

A new weights-and-measures card just issued by the Bureau is an excellent example of work of a more popular and general character, nevertheless of widespread interest and general utility. This card, commonly known as the "kitchen card," was issued in view of the considerable demand for an authoritative list of weights and measures tables and equivalents for use in the household, and contains a large amount of useful information. Upward of 400,000 requests were received for these cards; the Bureau was unable to fill more than one-tenth of these requests owing to the limited edition available. However, a number of women's journals and newspapers have reprinted the card for the benefit of their readers, and in a number of cases approval was requested by industrial organizations for printing the card in full for local distribution.

TECHNICAL CONFERENCES.

An effective means of promoting technical standardization in trade and industry is by conferences of experts held at the Bureau of Standards. Examples of such conferences of the year include those of the National Screw Thread Commission, the Thirteenth Annual Conference on Weights and Measures, the conference to improve conditions in the clinical thermometry industry, the conference on industrial safety codes, and smaller conferences on practically every phase of the Bureau's work.

In December a conference on industrial safety codes was held at the Bureau. This resulted in the formation of a national safety code committee representing the technical organizations concerned. Seven codes were recommended for sponsorship by the Bureau, including the national safety codes for electricity, gas, head and eye protection, fire, lightning, logging and sawmill operations, and aeronautics.

The conference on weights and measures is an excellent example of technical conferences. At this conference are represented the States of the Union, the larger municipalities, and the manufacturers of measuring devices used in trade. The conference was attended by 107 official delegates, representing 22 States, 40 cities,

and 29 counties. The representatives were mainly the State and city officials directly concerned with the inspection of trade weights and measures. The topics discussed included the technical details of inspection work, such as limits and tolerances allowable in trade measures, sealers' equipment for testing such devices, and the legal aspects of faulty measures. Important subjects discussed included commodity sales by net weight, standardization of loaves of bread and of package goods, and proposed legislation governing the installation and testing of gasoline pumps. After thorough consideration, the specifications and tolerances for liquid measuring pumps, which have become a matter of important public concern, were adopted by the last conference. The proceedings of the thirteenth conference, which will soon be ready for distribution, contain important discussions and technical papers on pertinent weights and measures subjects. The value of this work has steadily increased with the years. At its outset but two States could claim that the trade weights and measures were systematically inspected. Many States had defective laws, but even these were not enforced. At present, as a result of the Bureau's work and the excellent cooperation of State officials, at least half of the States have good laws, which are well enforced.

INVESTIGATION OF MATERIALS.

A most important part of the Bureau's work is the investigation of materials. These include structural materials, miscellaneous industrial materials, and technical materials in general use by the public. The first group includes metals, wood, cement and concrete, stone, plasters, paints, roofing materials, wall boards, etc. The miscellaneous materials include rubber, leather, textiles, adhesives, and similar products. The technical materials include such materials as optical glass, electrical insulating materials, etc. Such materials are primarily adapted to a special technical purpose. These materials are usually investigated in the physical laboratories of the electrical, heat, optical, and other divisions of the Bureau. Miscellaneous and structural materials are tested in a special division devoted to this work and housed in the industrial laboratory building.

A primary function in the field of materials is the development of standards of quality. A second class of work is the investigation of the efficiency of such materials in service and under conditions simulating service, including especially the causes of failure. An example of the latter is in the Bureau's continued investigation of the causes of failure of railway materials, wheels, axles, the metal parts of bridges, etc. It is impossible to do more than give a few illustrations of such work; for example, the investigation of the stresses in

the 350-ton crane at the Philadelphia Navy Yard, the cause of failure of a railroad bridge, the study of the stresses in car wheels by the heating of the rim during brake applications referred to elsewhere, the investigation of a reinforced hollow-tile floor construction, special investigations for the concrete ship enterprise of the Emergency Fleet Corporation, the causes of "popping" of lime plaster, and many similar problems.

It may be added that some of these investigations have resulted quite successfully. A solution of the "popping" of plasters was discovered, and in the "floor-slab" test, the results, probably the most complete ever obtained, will soon be made available in a Bureau publication. In connection with wooden airplane struts, it was found that the inequalities in the original wood introduces notable variations in the strength of the completed struts. In order to determine the deterioration of print paper with age, the paper laboratory of the Bureau is engaged in a comparison of recently made papers with similar papers tested by the Bureau 10 years ago. Forty samples show a decrease in bursting strength of 27 per cent. In the systematic comparison, however, it is necessary to take into account the relative accuracy in the test methods employed.

A research was completed by request of the leather industry on the efficiency of the two principal methods of tanning leather for shoe soles. The Bureau found after laboratory tests combined with 28 service tests that the chrome-tanned sole leather outwore the oak-tanned leather by approximately 23 per cent per unit thickness. Typical examples of chemical researches in materials include investigations of such subjects as treating of ropes to make them acid resistant, the bleaching and staining of cotton, the bleaching of pearl buttons from fresh-water clams, the fireproofing of mail bags for the aerial mail service, the production of an "ashless" filter paper for laboratory and industrial purposes, the physical properties affecting the behavior of printing inks during printing, the preparation of glue from salted fur seal flippers, and a large variety of chemical problems affecting metals and structural materials.

Another line of research on materials includes the development of new products. For example, the Bureau has cooperated in the development of a new fabric made of wood and waste silk which gives promise of satisfactory results. The Bureau has also worked on the problem of substituting paper sandbags in place of burlap bags and a special heavy paper of old rope was found to be suitable. The development of refractory materials designed to withstand high furnace temperatures is a special example of successful work in this field. A further class of investigations of materials includes the study of the efficiency of processes for working or measuring such materials; for example, the study of the welding of metals by the electric

arc. A successful strain gauge which will indicate at a distance the deformation in structures was developed at the Bureau. This will find a new and varied line of applications both in testing and research.

Many of the researches on materials require that they be cooled to the lowest attainable temperatures. For example, in the determination of the properties of materials throughout the widest range of temperatures. For this purpose the Bureau is equipped to liquefy all known gases except helium. The liquid-air plant is operated weekly in order to supply liquid air for technical use by the various laboratories of the Bureau, and in some cases to cooperate with other institutions. During the year a hydrogen liquefier designed at the Bureau was completed and installed and will provide sufficient quantities of liquid hydrogen for experimental work.

To illustrate the investigations on structural materials, those of cement form an excellent example. The Bureau is studying the effect of alkali waters on cement draintile, new methods for accelerating the hardening of mortars and concretes, the effects of storage on cement, the loss of water in molds, concreting troubles in cold weather, oversanded mixes, wet and dry aggregates, and similar problems.

A typical research was undertaken by the ceramics division to discover the cause of the chipping of metal enameled ware. This is a serious defect in such materials. After elaborate experiments the Bureau found that the chipping of the enamels was caused by the fact that on cooling and heating the enamel coating contracts and expands at a different rate from that of the metal itself. Investigations are being made of the compositions and heat treatment which will produce an enameled ware having the least tendency to chip. The results will be of considerable value both to the industries and to all users of enameled ware.

In the Bureau's investigations of causes of failure of railway materials the example of the breakage of car wheels in service is both interesting and important. As a result of study and experiment the Bureau found that the breakage was caused by the relative overheating of the car wheel at the periphery by prolonged application of the brake shoes while descending long grades. The Bureau experimentally reproduced this condition on sample wheels, carefully measuring the temperatures and checking the theoretical explanation. It was found that of the 28 wheels tested only 12 withstood the brake application. The remaining 16 broke on account of strains caused by the difference in the expansion at the periphery and at the center of the wheels, which results from the difference in temperature produced.

An important research on materials includes the Bureau's investigation of the chemical and physical properties of the platinum metals. As a first step in the platinum research program a large amount of

metal has been refined and purified from the lots furnished by other departments of the Government.

In order to promote the efficient utilization of natural gas the Bureau, at the request of the American Gas Association, investigated the theory and design of natural-gas burners, and as a result of this research developed a design for such burners which gives 100 per cent greater efficiency than is now obtained in the industrial use of natural gas. This result is equivalent wherever applied to doubling the supply of natural gas available. The Bureau has investigated the relative values of insulating materials used in cold-storage work. The investigation covered such factors as resistance to moisture, inflammability, strength, durability, heat conductivity, etc. The work was undertaken for the American Society of Refrigerating Engineers, which has taken a keen interest in this work. The Bureau has developed a satisfactory method for measuring heat conductivity, which has been described in a technical paper to be published for the use of refrigerating engineers. It is believed that this will go far toward placing this whole subject upon a standardized basis. Studies have been made of electrical insulating materials of many kinds. For some materials careful measurements have found changes as great as 40 per cent and variations in the material as produced at the factories. This work included development of methods of measuring the important electrical and mechanical properties of such materials.

COOPERATION IN STANDARDIZATION AND RESEARCH.

An important function of the Bureau is industrial research and standardization. It cooperates with the industries in fixing certain standards of quality and performance. These involve technical questions of suitability, methods, and instruments for testing, and to some extent the collation of service tests with the laboratory tests with a view to later improvement of the products. For example, the Bureau has lent its aid toward the adoption of an international system of tire sizes; in developing specifications for cotton fire hose, cotton bunting, rubber sheeting, mechanical rubber goods, plumbers' oakum, composite cloth, and in many other similar cases cooperated in formulating specifications or in special researches.

Marked activity was exhibited in the preparation of technical specifications for materials, excellent examples of which are the series of standard specifications for paints and paint materials, the publication of which is now nearing completion. These specifications were prepared under the auspices of the Bureau and passed upon by the technical representatives of the various Government departments, the draft being submitted for further suggestions to sev-

eral hundred of the leading paint experts of the country. Attention is invited to the value of such specifications or standards of quality as summing up the best knowledge of the subject and making it available to the entire industry. A technical specification properly prepared embodies the latest and best results of testing and industrial experience in a standard of quality recommended for general adoption. Of special interest is the series of industrial standards or specifications issued in an English-Spanish edition by the Bureau of Foreign and Domestic Commerce with the cooperation of the Bureau of Standards. A special field of specifications is found in the specialized use of particular materials; for example, lime. The many industrial applications of lime call for different grades or characteristics in the lime, and the Bureau is engaged in preparing suitable specifications covering each of the separate uses of lime.

Greatly renewed interest in aeronautic subjects reflected itself in demands for scientific information relating to all aspects of the subject. The Bureau cooperated with aviation interests in many ways. A study of foreign scientific aeronautic instruments was made, and in view of the greater activity abroad in this field the results will be of great value to American industry. Numerous manuscript reports fully illustrated were prepared for the National Advisory Committee for Aeronautics, and photographic and descriptive material for instruction was prepared as requested and furnished to the United States Institute of Technology, the United States Army Air Service, and the Bureau of Navigation of the Navy Department. The Bureau of Standards assisted manufacturers on technical details of aviation instrument design and construction.

Another form of cooperation is the drafting of technical codes or standards of practice to meet special cases. For example, a proposed set of standards for regulating central hot-water heating plants was formulated by the Bureau at the request of the public-service commission of the State of Indiana, and the rules were formally adopted by that commission. A similar circular on central-station heating is now practically completed and before publication will be revised in cooperation with the National District Heating Association and similar organizations.

In the Bureau's research undertaken to reduce the damage to underground structures by stray electric currents commonly called "electrolysis," the Bureau in cooperation with representatives of the national utility companies planned a comprehensive research program, which has been begun. This work has considerable economic importance in view of the well-known leakage losses of water and gas from distribution systems—losses estimated in millions of dollars. While this alone would justify an extensive research program, the

inconvenience to users of water, gas, and telephone service by interruptions, and the hazard involved as well, make the matter one of serious urgency. The part of the research program already under way relates to pipe drainage, underground systems, power distribution systems, and local installations designed to neutralize or mitigate the causes of the damage by electrolysis.

An important cooperative work was undertaken by the Bureau in connection with the committee of the American Institute of Electrical Engineers on the subject of the accuracy of commercial electrical measurements. The Bureau presented an exhaustive report on the subject, which was read and discussed at the national convention, copies being sent to electrical-instrument experts throughout the world for criticism and suggestion.

The Bureau also cooperated with a committee of electrical engineers in standardizing the nomenclature of storage batteries. With slight modifications, the Bureau's recommendations were approved and will be included in the new standardization rules.

The Bureau cooperated in furthering the adoption of standard nomenclature, abbreviations, symbols, and notation in radio terminology.

The Department of Commerce is a member of the American Engineering Standards Committee, the Bureau being represented by three members. An important work done by the Bureau for this cooperating organization was the collation of a complete list of 150 technical organizations engaged in or interested in engineering standardization.

The Bureau is cooperating with research agencies of many kinds. For example, research problems were suggested to a considerable number of university workers upon such subjects as electron-tube detectors, electron emission, circuit design for radio telephony, electron-tube measurements, and wave radiation, and assistance was rendered a number of universities in connection with such problems.

An interesting form of cooperation was undertaken by the Bureau with the Radio Research League for the study of so-called "fading" effect. This peculiar defect in radio transmission can not be predicted, and occurs suddenly, possibly due to some condition in the atmosphere. In order to gather a large amount of data, the Bureau arranged a cooperative investigation with 50 radio stations at which volunteer observers had agreed to observe and furnish reports. Many operators throughout the country joined in careful records of received signals, making regular reports to the Bureau. The results were gratifying, and 60 per cent of the possible number of reports were received, covering an average transmission distance of 350 miles, with wave length of 250 meters.

STANDARDIZATION.

Standards of measurement, numerical constants, standards of quality, performance, and practice are the groups into which the Bureau's work naturally divides itself. The organization of the work, however, is by subject and each division may be more or less engaged in perfecting standards of each of these types. For example, the wave lengths of light are being measured with the highest precision in the optical laboratory. Many of these wave lengths are now used as working standards not only for optical work but in the laboratory measurements of length, as in the standardization of gages and other products. Wave lengths of light are thus controlling the accuracy of machine-shop measurements. Again, the electrical resistance of pure platinum is now the means by which the ordinary temperature scale is now fixed in the range of −40° C. to 450° C. This involves the use of a standardized platinum resistance thermometer standardized at the temperature of melting ice (0° C.) and of steam condensing at normal atmospheric pressure (100° C.), and at the temperature of the vapor of sulphur boiling at normal atmospheric pressure (444.6° C.). This working scale replaces the use of the hydrogen gas scale previously adopted. In the electrical work standards of resistance were devised and constructed during the year, which combined with forced air circulation, permits the use of these standards practically without oil. This is an advantage which combined with the theoretical advantages makes the new standards effective and convenient for laboratory use.

Another example, the use of color standards, shows the practical utilization of apparently purely scientific data. The colorimetric laboratory is engaged in standardizing color by determining the wave length and the intensity. The practical aspect is that standards of quality for materials involve scientific specifications of color where the color is an indication of the desirable quality grade of the material, as for example, in paints, dyes, inks, textiles, paper, flour, soap, tobacco, butter, and other products. Numerous tests and research are in progress on theoretical and practical problems in the field of colorimetry. In measuring light intensity, the Bureau has just completed standard ratings of lamps in an interlaboratory comparison of the accuracy of lamp testing methods in various parts of the country. A number of laboratories cooperated in thus checking the methods and standards in use with a view to bringing about greater uniformity and accuracy in lamp testing. Somewhat more theoretical but of scientific interest is the careful study of the numerical constant of radiation, known as "sigma," σ. This is the most fundamental constant in all radiation work, and the Bureau's radiation expert by applying necessary corrections to the results of all observers finds

the average to be dependable to within 1 part in 500, very close to the value previously determined by the Bureau. The same laboratory issued 10 scientific papers during the year giving the results of its researches in the field of radiation.

Among the nomenclature standards for use in precision standardization the Bureau has cooperated particularly in the fields of colorimetry and electricity. The work in color terminology is especially complete and is planned to place the entire field on a basis of uniform practice in this regard which will be very helpful in future work in this subject.

The Bureau has been the agency in the investigation of screw-thread standards, Congress having established the National Screw Thread Commission. The work which has been in progress is summed up in the preliminary report of the commission, which is now ready to be issued. The work is of fundamental interest and practical value in mechanical engineering.

In the field of standardization, standards of practice relate to those factors of installation and operation which affect the efficiency, adequacy, or safety of a given service or process. The Bureau, with the cooperation of many national technical organizations, has now completed the final work on the National Electrical Safety Code. This will be printed in handbook form for the use of public utility commissions, electrical engineers, and the electrical industry generally. A second code is also now in press covering the protection of the heads and eyes of industrial workers. Other standards of practice will be issued in the near future.

Perhaps sugar, which is both a household necessity and a material of technical importance, may serve to illustrate the several classes of standards. Standards of measure are seen in the saccharimeter scale upon which by optical methods may be read the percentage of pure sugar in a given sample of raw sugar under test. The Bureau's research for several years furnished an important correction to this scale and to its 100-degree point, which is now known with high accuracy. The second class of standards, numerical constants, is exemplified in the rotation values of quartz, which is the basis of saccharimetry by which the sugar content may be measured by its optical effect in rotating the plane of vibration of light waves. Standards of quality are illustrated by the work of the sugar laboratory in developing specifications for high concentration sugar sirup, and in the standards being developed for specifying the quality of refined sugars now on the market. Such standards of quality will specify the composition, size of crystals, moisture content, color, and other pertinent properties. Since there are 40 varieties of sugar on the American market suitable for direct use, and current trade names throw no light on the quality of the sugar, the classification and

standards will benefit both producer and consumer. The specification of standard apparatus and standardized auxiliaries which give uniform values in the various port laboratories is an example of performance standards. Finally, standards of practice are shown by the very complete specification of the entire procedure in the local laboratories where import sugars are tested for the customs service. Another work, now in progress, aims to place the entire technology of sugar manufacture on the basis of scientific standards of practice based upon the most careful research.

GENERAL INVESTIGATIONS.

The research of the Bureau within its field has varied applications. For example, to industry, engineering, military technology, and scientific work. The kinds of research are quite varied. Some relate to methods for performing certain technical operations, others to comparison of relative merits of certain products, etc. Several examples will serve to illustrate the typical research problems undertaken.

In studying the performance of photographic filters and plates, a new sensitometer and methods for using the same have been developed and applied to 86 brands of American-made plates and filters. This work is of utmost importance to technical observations of photography. The work was done with great care, the density measurements alone numbering more than 8,000.

Since 1913 the Bureau has been making application of its special technique for hypersensitizing photographic plates so that they will photograph landscapes through fog. During the past year the Bureau has made special progress in increasing the color sensitivity and the speed of such plates by treating the plates with ammonia. A brief information circular on the subject was prepared and distributed, giving detailed instructions as to the preparation of such plates for maximum speed.

An important research was the measurement of the resistance of air to projectiles at high speeds. The Bureau's equipment permitted any desired air speeds up to the maximum. The results are expected to prove valuable in the study of ballistics. For this and similar purposes the Bureau is equipped with a high-speed wind tunnel, in which maximum wind speed of 250 feet per second can be obtained. The wind-tunnel equipment of the Bureau was used in determining the head resistance and stability of aircraft bombs and for other interesting researches in connection with an investigation of the serious effects of gun erosion during firing. The Bureau designed a special camera for taking panoramic photographs of the interior of a gun barrel. This is typical of auxiliary apparatus

which is designed and constructed at the Bureau shops in order to carry out experimental tests and make needed observations.

Another example of apparatus developed as a result of careful investigation of needs and methods is the rate-of-climb indicator. This improved aviation instrument was designed at the Bureau, constructed, and given a thorough and successful trial.

As a result, a contract was placed by the War Department for manufacturing a number of instruments. The instrument reads directly the rate of climb in hundreds of feet per minute.

Another interesting example developed as a by-product of wireless telephony investigation is a marked improvement in the wireless transmission of music was perfected in the radio laboratory of the Bureau. A carbon microphone was substituted for the vibrating diaphragm of the phonograph, so that the transmission was without sound at the transmitting end, but was reproduced easily and more distinctly at the distant receiving station. An important development in radio research was the design and construction of sources of alternating current of frequencies ranging from 200 to 10,000,000 cycles per second, for use in experimental work. Electron tubes of special design and special circuits were employed for the purpose. This is typical of a series of generators sets developed, each having special application, and is part of the radio development program of fundamental researches on radio methods and standardization.

A very practical development of the year was the successful trial, under service conditions, of the Bureau's proposed method of taking the bearings of a ship at sea by using the Bureau's direction finder on signals from shore radio stations. Similar results were obtained with the fog-signaling system developed by the Bureau in cooperation with the Bureau of Lighthouses. As a result, three permanent radio fog-signaling systems have been established at the Fire Island Lightship, Ambrose Channel Lightship, and the Seagirt Lighthouse.

Excellent examples of research for military purposes are shown in the investigations on searchlights and on gun firing. The latter involves ballistic principles and covers researches on the variation of gun pressure during firing, explosion times, ejection velocities, recoil, jump, and whip of guns, velocity of the projectile within the guns, blast investigation, and photography of projectiles in flight. The investigation of searchlights includes scientific studies of the transparency of the air to various color components of white light, the diffusing of light by air, the contrast sensibility of the eye, and accurate tests of searchlight mirrors.

Three investigations are in successful progress for the glass industry. During the year the Bureau has been studying the problem of producing clay pots for glass making of such composition and fabri-

cation as to resist the corrosive action of the glass and save much of the heavy expense now involved in new pots. The method is experimental, a large number of crucibles having been made and fired. The depth of penetration of the corrosion is being measured to grade the pots to select the type showing the least corrosion. Another investigation is the development of methods of producing an acceptable quality of soft glass tubing for chemical purposes. The inferiority of the domestic product prompted the Bureau to produce under controlled conditions sample lots of such tubing and distribute it for inspection and criticism to 20 leading authorities in various chemical laboratories. The reports were so favorable that endeavor is being made to interest American manufacturers in producing soft glass for chemical purposes equal to that of the best German product before the war. A third research of special interest to users of high-grade glass is the development of new and accurate annealing methods for eliminating the strains in glass to be used either for optical purposes or for making thermometers. The methods successfully developed are described in two technical papers already published and in a third which has been prepared for early publication.

The research value of the wind tunnel for other purposes than airplane research has been abundantly shown. One example is seen in a recently completed investigation of the large type of roof ventilators. A comparison of a large number of commercial types was studied in wind streams in the wind tunnel under service conditions, and the criteria for judging the relative efficiency was obtained by measurement. As a result a new type was developed which proved superior to a more complex and expensive type which showed the best results of the commercial varieties. The test was expanded at the suggestion of the American Society of Ventilating Engineers.

Among the newer lines of work that covering acoustical problems is of much interest, involving as it does the standards of practice for the design of assembly rooms to obtain the most effective audibility. The Bureau cooperated in a study of reverberation problems in Government auditoriums and Federal court rooms. In some cases the reverberations sustained the sound; at one time from 10 to 20 syllables were audible. The Bureau gave technical advice to the office of the Supervising Architect to enable him to correct existing difficulties and provide satisfactory construction on all new designs. The sound laboratory is also investigating the subject of soundproofing of walls and floors.

In the program of automotive power-plant research, five technical reports were issued during the year on cooling problems, and experimental work was completed on carburation and ignition, including both theoretical and experimental studies. The new method devised at the Bureau for measuring the rate of progress of the explosion

flame in an engine cylinder was used in the study of the effects of sparking time, fuel-air ratio and turbulence, and flame speed. A special type of sight window in the cylinder permits the visual observation of the flame in the cylinder. The general program of research includes cooperation with a large number of governmental and industrial organizations and experts on various problems affecting the efficiency, design, and operation of automotive power plants.

During the year the dynamometer building was equipped and occupied, and researches in power plants for airplanes and other motor craft were undertaken in the new quarters. The new building is equipped with an altitude laboratory of two vacuum rooms for simulating the conditions at high altitudes for testing engine performance with a view to improving the power and fuel economy and effectiveness of operation of aircraft engines at high altitudes.

During the year the ceramics research work occupied the new and well-planned laboratories in the industrial building and kiln house, and experimental research was taken up in clay technology, glass making, and enamels. An excellent research program on technical problems of interest in these fields is under way. It was shown practically that American clays of suitable quality are available for producing white ware of fine grades. Systematic tests were made to determine the mechanical strength of typical clays as a basis for choice of materials. About 60 well-known brands of fire brick were studied in the laboratory, and their properties are set forth in a technologic paper issued during the year. A decided improvement in the refractory materials used in the glass industry was effected, and material was developed which is less affected by the molten glass than those formerly employed. The glass plant turned out 20 large melts of optical glass from which large lens blanks were made, some of them weighing as much as 365 pounds. This is a pioneer class of work for this country. A very practical example of industrial research of general importance to the enamel metal-ware industry is the Bureau's pending investigation of the causes of the so-called "fish scaling" of enamel. The results of the research indicate that the difference in the expansion of the enamel and of the metal is the cause, and methods of minimizing the scaling were pointed out.

TESTING.

Apart from the Bureau's investigations and researches it does a large amount of testing of weights and measures, measuring instruments, materials, and appliances. These are of the most varied character, the weights ranging from the most minute assay weights to the largest industrial weights used in standardizing track scales. They include the most precise measurement of the wave lengths of

light to the standardization of surveyors' tapes one or two hundred feet in length. Time measurements range from the velocities of projectiles within the barrel of a gun to the rating of timepieces for variation in daily rate. Mechanical tests are made of the strengths of textile fibers and of materials of all sizes and strengths up to the strength of bridge girders. A few examples will give some idea of the volume of testing. More complete data will be found in the separate report of the Bureau's activities.

The Bureau inspected 1,200,000 lamps at the lamp factories. These were for delivery to the Government departments. About 2,000 were taken at random as typical samples and subjected to life tests in the Bureau's laboratories. Twenty thousand precision gages were tested for accuracy by the use of light waves. These gages are of the type developed by the Bureau during the war by new methods of manufacture and test. The test of these high-precision gages is an important function by which the Bureau serves the Government and the industries, and is especially important in promoting the efficiency of the American system of interchangeable parts, a vital factor in quantity production in the industries. The Bureau tests in some cases control the delivery of articles for Government use. In other cases they are quite special in their nature—for example, the tests of altimeters for world record airplane flights.

Another test included the material for the sails of the American cup defender *Resolute*. The autographic records of air pressure and air temperature attained by airplanes in high altitude flights on February 27, 1920, were studied in detail by the Bureau in order to determine the true altitude attained. A new form of test was applied to the recording instruments used in this flight. The instruments were placed in an air chamber in which the air pressure and temperature could be varied exactly as they varied in the flight in question, and were permitted to trace the autographic record of the conditions within the test chamber. This novel method is believed to be a most effective means of standardizing the readings of air-recording instruments. Thermometer testing showed a marked increase during the year. In all 25,658 clinical thermometers and 3,267 high-grade thermometers were tested. Only 85.5 per cent of the clinical thermometers submitted were actually certified after test owing to the excessive number of defective thermometers delivered to the Government for the Bureau of Animal Industry. The increase in the work, about 20 per cent over that of the preceding year, was accomplished with the same staff by use of improved methods. The testing equipment for precision thermometry has been supplemented by a new comparator, designed and constructed at the Bureau, which will accommodate 24 thermometers at one time. This will facilitate the expeditious handling of this work.

A marked increase in many lines of testing occurred during the year; for example, 5,795 precision and industrial weights were standardized during the year, an increase of 67 per cent, and 5,676 samples of standard materials were furnished to testing and scientific laboratories of the country for standardization purposes, an increase of 14 per cent over the previous year. More than $2,600,000 worth of radioactive preparations were tested by the Bureau—practically double the amount tested in any previous year—and indications are that the demand for such testing will continue to increase. During the year 543 miscellaneous optical tests were made, including binoculars, telescopes, etc., and 55 pieces of apparatus for sugar testing were standardized and certified, showing the corrections to be applied in order to give true readings on the international sugar scale. There were 9,317 chemical tests made during the fiscal year, a reduction from the war-time volume. The principal chemical tests were related to metals, cements, bituminous materials, lubricants, paint materials, soaps and polishes, inks, textile fabrics, and rubber. During the year 251 water-current meter ratings were made for different engineering branches of the Government. The testing of engineering and miscellaneous instruments and appliances continued as usual. In the capacity laboratory 5,571 pieces of volumetric glassware were tested. Seventy-eight per cent of the volumetric glassware tested was found to meet the requirements. This is a gratifying increase of 13 per cent over the ratio passed during the previous year.

During the year 560 large railroad and industrial track scales were tested by the Bureau, of which 58 per cent were found incorrect beyond the tolerance allowed. In addition, 14 master scales in various parts of the country were standardized in order that they might be used to standardize the local test cars employed by inspectors of railroad and industrial scales. The Bureau also inspected 221 mine scales, about two-thirds of which were found incorrect by amounts exceeding the tolerance limits. In the testing of electrical inductance and capacity there was an increase of 60 per cent over the preceding year. Most of this testing can not be done elsewhere in this country. The increase in the voltage on industrial electric transmission lines has been so great that the Bureau is required to increase the range of testing fourfold; that is, to 100,000 volts. The amount of testing covered about 170 aeronautic instruments, chiefly barographs, altimeters, tachometers, air-speed indicators, and a group of special aviation devices, such as inclinometers, rate-of-climb indicators, and air-speed computing devices. An increased interest in aeronautics has called for special testing of balloon materials, and 349 samples of balloon fabrics were tested with a view to developing a fabric of light weight and less permeable to gas. In order to permit higher stand-

ards of performance for range finders, the Bureau conducted an investigation of self-contained optical range finders by testing the accuracy on different types of targets, studying the relation between the accuracy of the instrument and its optical and mechanical design, and finally developing an adequate acceptance test.

The results of a very extensive fire test of building columns in cooperation with professional interests has been prepared for publication. Fire tests were made of 106 columns typical in design, material, and method of protection to those now employed in building practice. The publication will be approximately 400 pages, including technical illustrations, diagrams, and tabulations. The results will be a distinct contribution to the effectiveness of building design from the viewpoint of fire hazard. Similar investigations include the test of concrete columns, wall plasters, and protected steel flooring. A new standard test was developed and announced during the year known as a railroad precision watch test. The test is based upon the average accuracy of new railroad watches and permits a selection of excellent timekeepers which would, however, not pass the Bureau's class A test. The testing of timepieces showed definite progress during the year. The section tested 16,377 watches and other timepieces, including the highest grade watches, railroad precision watches, and watches for use on shipboard, stop watches, etc. New methods were devised for the test of stop watches and chronographs. An investigation in which this method was used disclosed many errors in many of the best-made watches—errors directly attributable to methods of manufacture. The time section prepared specifications for the purchase of stop watches, and these are now in use. In order to ascertain more fully the needs both of the watchmaking industry and of the users of watches, the time expert of the Bureau visited all of the watch factories in the United States and the time-inspection offices of five of the leading railroads. The result will be a more effective cooperation in timepiece testing.

BUREAU OF FISHERIES.

RELATIONS WITH THE FISHERY INDUSTRIES.

It is noteworthy that an unusual amount of interest is being manifested in the development of various branches of the fishery industries, and that there is a greatly increased demand on the Bureau of Fisheries for authentic and detailed information regarding the methods, trend, products, and statistics of the fisheries, and for more assistance in solving problems involved in the preservation, utilization, and marketing of products. While recent years have witnessed marked changes in the public appreciation of various kinds of aquatic foods, there is opportunity for further progress in this respect. Many millions of pounds of valuable fishes and other water creatures are still being wasted or put to uses of lesser economic importance because of lack of satisfactory methods of preservation and distribution.

The Bureau of Fisheries has met the increased demand on its services so far as the personnel and funds provided by Congress would permit; has made important contributions to the upbuilding of the industry; and is desirous and capable of rendering a larger measure of aid in various undeveloped fields of fishery enterprise. Among the activities that have yielded important economic results mention may be made of the following:

1. Improvements in the methods of salting fish have been developed; the possibility of preserving fish by this means in higher temperatures and warmer climates than heretofore has been determined; and successful practical demonstrations have been given in localities where previous attempts had failed.

2. The saving and utilization of by-products of the fisheries have been greatly extended, and large additions have in consequence been made to the output of products useful in the arts and industries, as, for example, the conversion of waste fish and fish waste into oil for use in paints and varnishes, for manufacture into fertilizer, and for conversion into meal available as stock feed; the saving of scales of native fishes for use in the preparation of pearl essence, heretofore imported in large quantity; the recovery and reusing of old salt and brine.

3. Aid has been given in the establishment of fisheries for sharks and other unutilized aquatic animals, from which such valuable products as leather, oils, and dried fins have been prepared.

4. Useful foreign methods are being introduced and brought practically to the attention of fishermen.

5. Satisfactory methods have been developed for canning abundant but hitherto neglected fishes, such as the mackerel of the Pacific coast; and difficulties encountered by canners in the preserving of various aquatic products are being studied with a view to standardization of methods.

One of the most interesting recent developments in the fisheries is the use of aeroplanes in locating schools of fish. The Bureau has been instrumental in securing cooperation between the Navy Department and commercial fishermen whereby naval seaplanes, with expert fishermen as observers, have been successfully employed in finding schools of menhaden and communicating the information to shore plants or to fishing vessels by means of wireless apparatus. The value of this novel method arises from the saving of expense due to needless cruising of fishing vessels and from increased production. The present indications are that, owing to the favorable outcome of the experimental trials, fishing companies will be regularly equipped with seaplanes and wireless installation for conducting this business as a private or cooperative enterprise, and there is reason to believe that the use of this method may be extended to other offshore marine fisheries.

The functions and activities of the Bureau of Fisheries which are concerned directly with the fishing industry have been handicapped by the failure of Congress to make provision therefor. Important efforts in behalf of the fisheries of the Pacific coast that were yielding results of great value have had to be abandoned; and the fishery-products laboratory in Washington, equipped with peculiar reference to the solution of practical problems that are impeding the development of the industry, has been almost idle. The opportunities and need for governmental assistance to the fisheries similar to that rendered in behalf of agriculture are generally recognized and appreciated; and it is hoped that Congress will give such support to this work as its great national importance demands.

PROPAGATION AND DISTRIBUTION OF FOOD FISHES.

The Federal fish hatcheries in all parts of the country have continued in an important degree to contribute to the available stock of food fishes in the ponds, lakes, streams, and coastal waters. The output of our hatcheries has reached every State. Many of the States depend wholly on the Federal Government for replenishing and

maintaining their local supplies of food and game fishes; others are conducting extensive fish-cultural work on their own account; while a few are cooperating actively with the Federal Government in collecting fish eggs and in distributing the resulting young. The annual sacrifice of fish life is so great through commercial fishing and angling that there is a steadily growing demand for artificial aid, which is still further required in order to offset the losses that occur through the contamination and obstruction of waters.

Among the important fishes whose artificial propagation is regularly carried on by the Bureau are the salmon, shad, striped bass, and yellow perch in the rivers of the Atlantic seaboard; the chinook, sockeye, silver, humpback, chum, and steelhead salmons in the Pacific States and Alaska; the whitefish, cisco, and pike perch in the Great Lakes; the catfishes, buffalofishes, trouts, landlocked salmon, and basses in the interior waters; and the cod, haddock, pollock, and flounder on the New England littoral.

The output of food fish in 1920 included 3,872,218,000 fry and 267,388,000 fingerlings, yearlings, and adults, together with 630,749,000 fertilized eggs, a total of 4,770,355,000. The policy of rearing to the fingerling stage as many fish as possible has been consistently followed, and the distribution of fingerlings during the year was approximately 116,000,000 in excess of any previous season. Owing to the defection of skilled employees, the high cost of supplies and temporary labor, and unfavorable weather conditions in fields where large egg-taking operations were in progress, the output as compared with 1919 showed a decrease of about 1,100,000,000.

It is a pleasure to be able to announce that between the Bureau of Fisheries and the fish commissions of the various States there now exist closer and more helpful relations in fish culture than at any previous time. Each season a larger number of field stations are maintained under a cooperative arrangement with the States; and each year there is additional evidence of the benefits arising from the coordination of National and State fishery work. In 1920, 24 States received from the Bureau of Fisheries assignments of fish and fish eggs aggregating 666,000 fingerlings, 3,016,000 fry, and 232,137,000 eggs, these last being sent to the State hatcheries to be incubated and the resulting young planted in local waters under the auspices of the State authorities. The States, on their part, have in various instances afforded invaluable assistance to the Federal agents.

The low salary scale in the fish-cultural service of the Federal Government compared with that in the fish commissions of various States, and the much higher pay received by untrained, unskilled labor in the communities in which the Department conducts fish-cultural operations, have naturally led to the depletion of the regular staff of the Bureau and the creation of a feeling of discontent among

those who have remained in the service. In the lower grades of fish-culturist approximately two-thirds of the statutory positions have for months been either vacant or temporarily filled by old men and boys without proper qualifications. In the numerous instances in which, in the stress of operations, superintendents and foremen need to go outside the service for assistance they find themselves obliged to employ persons, often with decidedly less ability than themselves, at rates of pay largely in excess of what the Government provides for its permanent men of long experience and proved efficiency.

The fact that under the distressing salary conditions that have prevailed at the various hatcheries the work has gone along not only without total collapse but without serious impairment speaks for the loyalty and efficiency of the personnel; but it would be most unwise for Congress to infer that such a situation can or will continue indefinitely, and to further delay the payment of proper salaries will virtually encourage or invite the disintegration of a trained force that is contributing largely to the country's food supply.

SALVAGING STRANDED FOOD FISHES.

A conservation measure of vast importance is the rescuing of food fishes that are left in temporary ponds, lakes, pools, and sloughs on the subsidence of the floods of the Mississippi River and tributary streams. The annual losses of valuable fish life owing to the drying or freezing of all these shallow waters have been enormous and have affected the food supply of the entire region from Minnesota and Wisconsin to Mississippi and Louisiana. Similarly, the efforts at conservation have a widespread effect. Thus the situation is clearly one that comes under the Federal purview, and the Bureau of Fisheries has assumed the task of mitigating, as far as resources will permit, the yearly destruction of food fishes, its operations being supplemented by those of several States.

During the fiscal year 1920, more particularly in the period from July to November, the number of food fishes rescued from the overflowed lands bordering the Mississippi and tributaries reached the noteworthy total of 156,659,000, all of which would inevitably have perished. This salvaged output, which was about 100,000,000 in excess of the results in any previous season, was returned to the open waters in the vicinity of the points of collection, with the exception of less than 1,000,000 fishes of various species of bass that were used in supplying individual applicants or in satisfying the requisitions of the fish commissions of the States bordering on the sections of the river where the work was conducted.

There is no form of fish conservation that can compare with this in effectiveness and cheapness. The young fish saved in the 1920 opera-

tions, if they had been hatched and reared in the usual manner at the ordinary fish-cultural establishments, would have required several hundred such stations to produce. The entire cost of the rescue work was only 13 cents per 1,000 fish for about 75 per cent of the output. The expense was higher at certain points where the collections were lighter and the overhead charges were fixed, so that the average cost was somewhat under 20 cents per 1,000 fish rescued and planted.

The need for this kind of work is obvious. The opportunity for increasing it is practically unlimited. The only drawback is the lack of funds. In future appropriations for the Bureau of Fisheries, Congress should make ample provision for extending this important service which contributes so directly to the augmentation of the food supply.

BIOLOGICAL INVESTIGATION AND EXPERIMENTATION.

The effect of chronic salary insufficiency in the Department has nowhere been more marked than in the disintegration of the staff of trained biologists in this Bureau, whose services are essential for the study of important problems in the culture, conservation, and utilization of aquatic creatures. During 1920 the number of resignations among the technical personnel represented about 36 per cent of the entire staff and involved positions of major responsibility. Other employees in this class have indicated that their continuance with the service should be regarded as conditional or tentative. This situation has been brought about by the inadequacy of compensation, both absolute and relative, and by the greatly superior financial inducements offered outside the Government service. The year therefore closed with the Bureau in weakened position for effective service in this highly important field.

Notwithstanding this serious handicap, which was supplemented by a reduced appropriation, substantial results have been secured in biological investigation, owing in part to the fact that many of the scientific assistants who resigned after the beginning of the fiscal year 1920 remained in the service long enough to contribute to the year's accomplishments.

Several investigations have been directed at fundamental problems underlying the successful artificial propagation, the provident utilization, and the intelligent conservation of important fishes. Studies of the habits, migrations, and life history of the Pacific salmons have been continued. Anatomical examinations of several members of the salmon family that are extensively propagated in ponds have indicated the possibility of improved methods of handling breeding fish to prevent injury and disease and to secure long-continued fertility.

A material advance has been made in the knowledge of the whitefishes of the Great Lakes, as a basis for more efficient protection and cultivation of the various species that support valuable fisheries.

In the field of experimental fish culture the investigations of previous years, relating to the important rôle of aquatic plants, supplemented by observations at several fish-cultural stations, have yielded certain definite conclusions which have been of fruitful application in fish-cultural practices at pond stations. Additional studies have been made of the various natural foods of fishes in ponds, contributing information which is essential to the lifting of pondfish culture to a plane similar to that of intelligent agriculture.

Fish diseases have received consideration at public and private hatcheries, remedial actions have been proposed, and in particular cases, where the remedy is not known and the conditions are of widespread occurrence, researches have been initiated to discover the causes of trouble and the means of prevention or cure.

Special attention has been given to the oyster industry, and to some of the serious problems confronting it the Bureau has extended the fullest possible measures of aid. In the Long Island Sound region the results of investigation now point rather directly to a chain of causes for the failure of the set during a period of years, but a continuance of the present investigations and experiments is necessary before the conclusions can be substantiated and definite alleviative measures proposed.

In fresh-water mussel propagation there has been a material increase in output as compared with the year immediately preceding, although the records of previous years have not been equaled. The experiments in fresh-water mussel culture have yielded results of interest and promise. The Bureau has met with a gratifying degree of success in its efforts to induce the several States to take appropriate action for the protection of mussel resources, and several States bordering the upper Mississippi River are now putting into effect laws which should go far to preserve the mussel fishery in waters within their jurisdiction.

The results of investigations into the reddening of salt fish, especially the cod and its relatives, have served to fix definitely the cause of the trouble in certain minute organisms which grow upon the fish and are introduced with imported salt. The organisms have been isolated, some of the conditions of their growth have been determined, and means for the alleviation of a trouble which causes substantial losses each year to the packers of salt fish have been proposed. The essential step in the control of this situation is the sterilization of the salt at the place of production.

At the fisheries biological station at Fairport, Iowa, an admirable new laboratory building has been completed to replace the frame

structure which was destroyed by fire in December, 1917. At the Key West (Fla.) biological station the water system was made operative by the installation of engines and pumps and the construction of a concrete tank tower with tanks for salt and fresh water. Further construction work at the station was prevented by virtual exhaustion of the special appropriations.

The steamers *Albatross* and *Fish Hawk* have been kept in operation during part of the year in oceanographic and fishery exploration work, the former cruising first to the south as far as the Yucatan Channel and later working in the Gulf of Maine; the latter being engaged in biological and fishery investigations in the Chesapeake Bay.

A public service that has been most valuable and has been highly appreciated by Federal, State, and local health authorities has been rendered through the detail of an assistant for cooperation in the antimalaria campaign in southern States. In consequence of investigations conducted during recent years, some of the conditions of the proper use of small fish in combating mosquitoes have been determined, and it has been possible by advice and demonstration to make feasible the adoption of " fish control " in certain localities as a means of exterminating mosquitoes, with advantages both in the substantial reduction of the cost of sanitary campaigns and in alleviating conditions where other means of control of mosquito breeding were impracticable.

ALASKA SALMON FISHERIES.

The chief function of the Department as regards the fisheries of Alaska is the enforcement of the laws and regulations for maintaining the salmon supply. During the active fishing season of 1919, 15 men were added to the regular force and there was a patrol of the fishing grounds from the southern international boundary line to the Yukon River. A similar patrol, with the corps of statutory agents and wardens supplemented by temporary employees, has been maintained in 1920.

Following the phenomenal season of 1918, when the Alaskan fisheries as a whole reached their highest development because of the great increase in the salmon fishery, the season of 1919 showed a marked decline, principally in the salmon industry. From data collected and published by the Bureau, it appears that the number of persons employed in the Alaskan fishery industries in 1919 was 28,534, a decrease of 2,679 from the previous year; the capital invested was $74,181,560, an increase of $430,771; and the value of the products was $50,282,067, a decrease of $8,872,792. The pack of canned salmon was 4,583,688 cases of forty-eight 1-pound cans, valued at $43,265,349, a falling off of approximately 30 per cent in quantity

and 15 per cent in value. Other products brought the value of the salmon output to $49,944,866.

In order to secure the escapement of adequate numbers of spawning salmon, further restrictions for the season of 1920 were imposed on commercial fishing operations in the waters of southeastern, central, and western Alaska, as the outcome of public hearings held in November, 1919. Hearings in anticipation of still further curtailment of commercial fishing in certain waters have been announced for the autumn of 1920, and the Department will take such action in each case as the facts may warrant. One of the streams involved is the Yukon, where a special investigation has been made for the purpose of ascertaining the actual conditions as affecting the needs of the natives and the preservation of the salmon supply. The inauguration of commercial fishing on the Yukon in 1918 has occasioned much discussion and given rise to fears in some quarters that the salmon run may be permanently impaired and the welfare of the dependent natives seriously jeopardized. A bill prohibiting commercial salmon fishing in the Yukon was under consideration at the last session of Congress, but action thereon was deferred in the expectation that the Department would take appropriate action before the 1921 fishing season.

The systematic stealing of salmon from traps was the cause of no little annoyance and loss to the industry in 1919 and 1920. While the Department is not vested by law with any jurisdiction in this matter, it has cooperated as fully as practicable with the appropriate agencies that are endeavoring to suppress this nefarious business.

Two cardinal requisites now confront the Department in its administration of the fisheries of Alaska, and it is hoped that the next Congress will give to this subject the sympathetic consideration that its importance merits.

There is urgent need for a general revision of the fishery laws of Alaska. The regulatory, revenue, and other features of the existing laws have been shown to be highly unsatisfactory under present conditions. The Department has for many years been seeking relief at the hands of Congress, and a number of comprehensive bills have been drafted after protracted hearings, but no bill has passed, and the fisheries, at the most critical stage in their history, are under the control of laws that are generally recognized as obsolete and inadequate.

The Department should have a material augmentation of its facilities for protecting the salmon fisheries of Alaska. This means larger appropriations and increased personnel. The large revenue derivable from the salmon industry has never been applied to the maintenance of that industry but by law is used entirely for other purposes under the Territorial Government. In the face of inadequate appro-

priations by Congress it would be a sensible and obvious course to make available for this purpose a part of the money obtained from taxation of the fishing industry, as provided for in several bills to which the Department has given its approval in recent Congresses. It is improbable that in any other country in the world does there exist such an anomalous situation as characterizes the present administration and control of the Alaska fisheries.

ALASKA FUR-SEAL SERVICE.

Commercial sealing operations on the Pribilof Islands in the calendar year 1919 were conducted on a rather less extensive scale than in 1918, owing to the inadequacy of the local labor force and the miscarriage of the plans for augmenting that force by white and native assistance. The disorganization of transportation resulting from the epidemic of influenza made it impossible for the additional helpers to reach the islands. The surplus male seals taken for their skins numbered 27,821, of which 7,731 were from seals 6 or more years old.

For 1920 the quota of seals to be taken was tentatively fixed at 35,000. Laborers from the Aleutian Islands and special sealing men from the fur house of Funsten Bros. & Co., of St. Louis, were on hand to assist in the work during the height of the season. Up to August 10, when the commercial killings ceased, the number of male seals taken was 25,978. The skins secured in 1920 were mostly from seals 3 and 4 years old, as the proper proportion of the older males has now been established.

During the fiscal year 1920 there were three public auction sales of Government sealskins in St. Louis, in accordance with the terms of the contract with Funsten Bros. & Co. The number of skins disposed of was 23,907, all of which were dressed, dyed, and machined before being offered for sale. The high quality of these furs was attested by the active demand and good prices, the total gross amount of the sales being $2,534,183.50.

The net proceeds from the sale of sealskins deposited by the Department in the United States Treasury in 1920 was $1,457,790.57, this sum representing in part some skins sold in the previous fiscal year, for which returns were not received until 1920. The amount named is in addition to $271,894.48 set aside as the shares of Great Britain and Japan under the terms of the fur-seal convention.

The fur-seal herd is increasing in accordance with natural law, and this increase is not in any manner adversely affected by the commercial utilization of the surplus males. The different elements of the herd are being maintained in approximately the proportions recommended by those who have made a careful study of the biology of the fur seal, and it is thought that the determination of the numbers and ages that should be killed hereafter will be greatly simplified.

Revised figures of the seal census of 1919 gave 524,235 animals of all ages as of August 10. Tentative figures for 1920 showed 548,473 animals on August 10, in addition to which 28,418 had been killed subsequent to the previous census. The increase from 1919 to 1920, exclusive of killings, was 10.4 per cent.

The welfare of the native inhabitants of the Pribilof Islands has received full consideration. Food, clothing, fuel, shelter, and medical service have been provided, and schools have been maintained. The natives in return have performed in a creditable manner, under supervision, most of the manual and technical duties connected with the sealing and other operations.

The Department of Commerce is under obligations to the Navy Department for the transportation of the major portions of the extensive supplies sent to the Pribilof Islands in 1919 and 1920 and also for the transportation of employees and sealskins. This service was performed by a vessel used primarily in taking supplies to the naval radio stations in Alaska, one of these stations being on each of the Pribilof Islands. The recently acquired vessel *Eider* has rendered valuable service in transporting persons and supplies for the Bureau of Fisheries between Unalaska and the Pribilof Islands. Never before in the history of these remote islands has there been such close connection maintained with the outside world; this has been especially important during winter.

Congress has usually dealt liberally with the Pribilof Islands in the matter of both general and special appropriations, although in recent years the funds made available have not always proved ample, owing to the increasing costs of supplies, materials, and labor. In view of international interest in the fur seals, the importance of the islands as sources of a very considerable revenue, and national obligations with regard to the natives, Congress should continue to make adequate provision for maintenance and for expansion of operations. One of the more urgent needs at this time is the replacement of the houses occupied by natives and Government agents; most of the domiciles are very old and are too far advanced in decay to justify repair.

MINOR ALASKAN FUR-BEARING ANIMALS.

The enforcement of law and regulations for the preservation of the minor fur bearers of Alaska has been attempted with a small corps of wardens located in the most important districts. Inspections of furs and of trapping operations have been made and large seizures have resulted of furs taken illegally. Convictions, with fines and jail sentences, have been secured in some cases and other prosecutions were pending at the close of the year.

One change in the regulations for the protection of the fur-bearing animals was made during the past year by the issuance on January

9, 1920, of an order extending the close season on sea otters to November 1, 1925.

Statistics of the shipments of furs from Alaska have been compiled by the Bureau as heretofore. The Post Office Department and common carriers have cooperated in furnishing reports of shipments of furs by mail and otherwise. The value of the furs sent out of Alaska in the year ended November 15, 1919, exclusive of the skins taken on the Pribilof Islands, was $1,379,348, as against $1,305,421 in the previous fur year. There was a diminished catch of many kinds of fur bearers, but pelts brought higher prices.

The Department is pleased to be able to announce that by the act making appropriations for the Department of Agriculture for the fiscal year 1921, approved May 31, 1920, jurisdiction over the land fur-bearing animals in Alaska was transferred from the Secretary of Commerce to the Secretary of Agriculture, and the control over walruses and sea lions heretofore exercised by the Secretary of Agriculture was vested in the Secretary of Commerce. This change had long been advocated by the Department of Commerce. Jurisdiction over the Pribilof Islands, with their fur-seal and fox herds, remains with the Department of Commerce.

FOX HERDS OF PRIBILOF ISLANDS.

An industry on the Pribilof Islands, incidental to the sealing industry but of very considerable importance, has its source in the blue-fox herds on the islands. The revenue to the Government resulting from the sale of pelts is solely the result of the Government's activities. Without the food supplied and general care exercised by the Government agents, the herds would dwindle to the insignificant number which might be able to eke out a precarious existence feeding on the beaches in the winter season, and they might disappear altogether. The beneficial results derived from active steps to maintain the foxes through the winter season are demonstrated fully on St. George Island where for a number of years seal carcasses or waste portions thereof have been preserved for winter food for foxes. The take of fox pelts on the Pribilof Islands in the season of 1918–19, amounting to 667 blue pelts and 30 white pelts, was, with the exception of 2 blue pelts temporarily retained for exhibition at Washington, sold at public auction in St. Louis on September 10, 1919. The 665 blues brought $130,274.50, an average of $195.90 per skin, and the 30 whites, $1,660, an average of $55.33 per skin. The take of fox pelts in the season of 1919–20, consisting of 901 blues and 37 whites, was the largest in 25 years. The skins await sale at the present date. The increased abundance in the last season is most gratifying, particularly so since the results are believed to be due to the direct efforts, cumulative in effect, put forth during recent years to improve the herds.

BUREAU OF LIGHTHOUSES.

AIDS TO NAVIGATION.

The regular work of the Lighthouse Service in establishing, maintaining, and improving aids to navigation was actively carried on during the year.

A total of 634 new aids to navigation was established, including 172 lights, 60 gas buoys, and 402 other aids. The total number of aids in commission June 30, 1920, was 16,324, being a net increase of 256 over the preceding fiscal year.

During the year 69 new aids were established in Alaska, including 17 lights, 3 gas and bell buoys, and 50 other aids. The total number of aids to navigation in Alaska at the end of the fiscal year was 535, being a net increase of 60 over the preceding fiscal year.

Work was continued during the year in repairing damage to aids to navigation caused by ice during the winter of 1917–18, especially to screw-pile structures in Chesapeake Bay and Potomac River. The work of repairing hurricane damage to aids in the Gulf of Mexico was also vigorously prosecuted during the year.

Various special works were actively carried on during the year, including the establishment of important light and fog signal stations and lighthouse depots, improvements in systems of fixed aids and buoyage, etc. The more important special works completed during the fiscal year are as follows: Improvement of the lighting of Ambrose Channel, into New York Harbor, by the use of modern acetylene buoys; completion of the lighting of the new Chester and Marcus Hook dredged channels in the Delaware River by means of ranges; construction of a light and fog signal on a caisson structure near Cape Charles City, Va.; construction of a light on the west pier at Huron Harbor, Ohio; and the construction of a concrete light and fog signal building at Manitowoc Breakwater, Wis., to replace the old, worn-out building. Progress was made on various special works not yet completed, including the improvement of aids to navigation on the St. Johns River; lighted beacons for Molasses and Pacific Reefs, Fla.; improvement of lighting of the Mississippi River below New Orleans; new lighthouse at Point Borinquen, P. R.; rebuilding of Point Jiguero Lighthouse, P. R.; lighthouse and fog signal at Conneaut Harbor, Ohio; aids to navigation Keweenaw Waterway,

Lake Superior; and improvement of aids to navigation, St. Marys River, Mich.

Improvement in illuminating and fog-signal apparatus of existing aids was continued during the year. Fixed lights were replaced by flashing or occulting lights at 44 stations; incandescent oil-vapor lights were substituted for oil-wick lamps at 3 stations; and acetylene or electric incandescent illuminant was substituted for other illuminants at 60 stations. New fog signals were established at 5 important stations, and the fog-signal apparatus at 5 important stations was improved by the substitution of more efficient apparatus.

General repairs required for upkeep of aids to navigation in efficient working condition were continued during the year so far as available funds permitted, but the funds available were far from sufficient for the proper upkeep of this large amount of public property.

Damage to lighthouse property estimated at $245,000 was sustained in the seventh and eighth districts by hurricane of September 8 to 16, 1919. The act of March 6, 1920, appropriated $125,000 for repairing this damage.

The severe storm which prevailed along the Middle and North Atlantic coasts early in February, 1920, resulted in considerable damage to lighthouse property and caused two light vessels to break from their moorings.

The act of June 4, 1920, authorized the establishment of post lights and other aids to navigation on the Yukon River and its tributaries.

VESSELS.

As explained in detail in the annual report for 1919 (Appendix A), there is very urgent need for the construction of additional vessels for the Lighthouse Service to replace those worn out in service, those lost through various casualties, and to meet the considerable growth of the Service. The total number of vessels available for this Service is now actually less than it was 10 years ago, although the number of aids to navigation maintained has increased 39 per cent in this period. The act of June 5, 1920, authorized a building program for vessels to the amount of $5,000,000, but no funds were appropriated.

At the close of the fiscal year 55 tenders and 62 light vessels were in commission. New light vessels *No. 99* and *No. 103*, under construction, were well advanced at the close of the fiscal year. These will be placed in commission on the Great Lakes as early as practicable. A small wooden vessel, now the tender *Shrub*, was transferred by the Navy Department and altered to adapt her to the work of the Lighthouse Service.

One tender and three light vessels were surveyed, condemned, and sold during the fiscal year. The nominal bids received for these

vessels indicate their extremely unserviceable and worn-out condition and the necessity of withdrawing them from further service.

The act of November 4, 1919, appropriated $450,000 for a light vessel to replace Diamond Shoal Light Vessel, which was sunk by a German submarine during the war, and light vessels *No. 105* is under construction. The same act appropriated $760,000 for replacing vessels worn out in service and the tenders *Oak* and *Hawthorn* are being built.

LIGHTHOUSE DEPOTS.

A lighthouse depot, very much needed for the Alaska district, has been partially built at Ketchikan, Alaska, under appropriations of $90,000 and $12,000. While the wharf and storehouse are in use, the funds are not sufficient to complete the depot.

Work on the construction of a new lighthouse depot at Chelsea, Mass., for the second lighthouse district, under an appropriation of $85,000 made by act of July 1, 1918, was in progress, but the amount will be insufficient to complete the depot.

Important improvements are in progress at the general lighthouse depot, Tompkinsville, N. Y. Under the appropriation of March 28, 1918, of $60,000 for repairs to wharves, portions of the old wooden wharves are being replaced by concrete decks with cast-iron pile columns.

Under the allotment of $175,000 in August, 1918, from funds for national security and defense, a new plate and boiler shop has been built at this depot, and new concrete coal bins are being constructed It is expected to complete this project in November, 1920.

The act of June 20, 1918, authorized $275,000 for improvements at the lighthouse depot at Portsmouth, Va., or establishing a new depot, but no appropriation has been made for this work. This is the principal depot of one of the largest lighthouse districts and is the headquarters for five tenders and two light vessels during the greater part of the year. The facilities for berthing these vessels are entirely inadequate and, in consequence, the efficient operation of the vessels is much hampered. The inadequacy of space for storing and handling buoys also causes much delay and loss. Increased facilities for this depot are urgently necessary.

The act of June 5, 1920, authorized $250,000 for a new lighthouse depot at Key West, Fla.; $120,000 for a depot at Honolulu, Hawaii; $16,500 for improvements at Goat Island lighthouse depot, San Francisco, Calif.; and $60,000 for improvements at the Charleston, S. C., lighthouse depot; but no appropriations have been made for these works.

IMPROVEMENT OF APPARATUS AND EQUIPMENT.

Radio equipment was installed on 3 light vessels and 4 tenders during the fiscal year. At the end of the fiscal year 42 light vessels and 27 tenders in all had been equipped with radio apparatus.

Improvement of intercoastal communication by the installation of telephones at light stations was continued during the year by the Coast Guard. On June 30, 1920, 274 light stations had telephone connections.

Experiments and tests continued during the year with various devices and equipment used in lighthouse work have resulted in developing improvements in the interest of efficiency and economy in the Service. A new type of winch for hoisting and lowering boats at light stations to replace the old type of winch, which has been the source of numerous casualties, has been developed and installed at some light stations.

The automatic aerial fog bell having a striking mechanism operated by compressed carbon-dioxide gas has been continued in service during the fiscal year on a buoy in the fifth lighthouse district, replacing the former Bush Bluff Light Vessel, and has been sufficiently satisfactory to warrant a second installation which has been placed on an unwatched fixed structure making the approach to Cape Charles City, Va.

Experiments recently completed with a new type small upright oil-gas mantle indicate that this type is as efficient as the old type, consumes less gas, and is more easily installed and handled.

A light, tall type metal cone buoy, designed to replace wooden buoys which were subject to damage by ice, etc., has been developed for use in shoal-water channels and has proved efficient.

In cooperation with the Bureau of Standards tests were made for the purpose of determining efficiency of radio fog signals automatically sent from light stations and light vessels and a radio compass on a vessel to enable bearings to be taken of the fog-signal stations from the vessel. Installations were made at three light stations in Chesapeake Bay, and an improved type of radio compass was experimentally installed on a lighthouse tender. Further experiments with improved apparatus are now in progress.

A 6,000-pound mercury float and pedestal, probably the largest constructed in this country, was installed at Cape Fear Light Station, N. C., replacing the worn-out lens chariot in use since the station was established in 1903.

PERSONNEL.

On June 30, 1920, there were 6,002 persons employed in the Lighthouse Service, including 124 technical, 158 clerical, and 5,720 con-

nected with light stations, vessels, and depots. This Service is charged with the maintenance of aids to navigation along 49,012 statute miles of coast line and river channel, including 1,712 miles of the Yukon River and its tributaries for which aids to navigation were authorized by act of June 4, 1920.

SAVING OF LIFE AND PROPERTY.

During the fiscal year services in saving life and property were rendered and acts of heroism performed by employees of the Lighthouse Service on 129 occasions. Many of these acts were especially meritorious and the employees were individually commended by the Department.

ADMINISTRATION.

The appropriations for the maintenance of the Lighthouse Service for the fiscal year 1921 are $7,837,290, being $248,860 in excess of those for the preceding fiscal year, and include $70,000 for retirement pay. In addition, there are special appropriations aggregating $1,366,600, contained in deficiency appropriations of November 4, 1919, and March 6, 1920, $1,210,000 of which was appropriated for tenders and light vessels and $125,000 for repair of hurricane damage in the seventh and eighth districts.

Systematic inspections have been made of the technical work, business methods, and property accounts in the various lighthouse districts.

The retirement act of May 22, 1920, which provides a system of general retirement for the civil employees of the Government, will be of much benefit to those employees of the Lighthouse Service who were not covered by the retirement law of June 20, 1918, providing retirement for certain classes of employees in this Service.

SPECIAL LEGISLATION NEEDED.

INCREASE OF STATUTORY SALARIES.

The legislation most urgently needed for the Lighthouse Service at the present time is a revision of the salaries now fixed by statute, and other legislation for improving the status of the personnel, so as to permit the Service to again attract, as it formerly did, a high grade of faithful and efficient employees. The apparent increase in appropriations required to do this will in the end result in economy, for the reason that in the carrying on of highly technical work such as that of the Lighthouse Service there is great waste through loss of time and ineffective work when, as has become more and more the case in the last few years, the Service does not offer

sufficient inducements in the way of compensation to attract to it a personnel suited to its special needs, nor to retain for long the best of those who do enter it. Unless early relief is afforded the conditions in this Service will steadily grow worse, as the proportion of trained and efficient personnel diminishes through natural causes and through resignations of valuable employees who, hoping for improved conditions, have thus far remained with the Service notwithstanding better opportunities.

Congress has recognized the importance of the problem through the appointment of the Congressional Joint Commission on Reclassification of Salaries, which made a report on March 12, 1920. This report fully shows the need of readjustment of salaries and systematic grading of positions. While Congress has as yet taken no action on this report, it did at the last session grant substantial increases of compensation for several services of technical character, as, for example, to officers of the Army and Navy, to the Coast Guard, and to the field officers of the Coast and Geodetic Survey. The responsibilities, technical requirements, and duties of various portions of the Lighthouse Service are quite comparable with various groups in each of the services mentioned, and, so far as the military needs of the country enter into the question of compensation, the situation fully justifies equal consideration for the personnel of the Lighthouse Service. The act of August 29, 1916, providing for transfer of the Lighthouse Service, in the discretion of the President, to the Navy or War Department in a national emergency is practically identical with the law as to the Coast and Geodetic Survey, and is effectively similar to that for the Coast Guard, and under this law the President actually transferred 1,132 persons of the Lighthouse Service during the recent war, and they, with 50 vessels and 21 stations, remained on duty with the Navy for over two years.

From the practical standpoint the situation simply is that with increases of food and other living expenses of 100 per cent and more the dollar now represents but 50 cents of its former value, and the salaried classes of persons in the Lighthouse Service, particularly those whose salary is limited by statute, are not able to sustain their families and themselves in the reasonable manner to which they are entitled and the pay formerly fixed led them to expect.

INCREASE OF RATION ALLOWANCE FOR LIGHT KEEPERS.

The commutation of ration allowance authorized by the act of June 20, 1918, at 45 cents per day is now quite insufficient to purchase food for one person for a day, and legislation is needed authorizing its increase to an amount reasonably sufficient for the purpose.

PROVISION FOR RETIREMENT FOR DISABILITY, AND OTHER CHANGES IN LIGHTHOUSE SERVICE RETIREMENT LAW.

The act of June 20, 1918, providing for retirement of certain classes of persons in the Lighthouse Service has proved beneficial both to the Service and the persons affected. The general retirement law of May 22, 1920, covers many of the persons in this Service excepted from the special law and will also be of broad benefit.

For the persons in the Lighthouse Service covered by the act of June 20, 1918, it is very desirable that the retirement provisions be extended to cover cases not due to vicious habits or misconduct, where an employee is found to be disabled for useful service before reaching the age fixed in the act. Because of the responsible and arduous character of much of the work, especially on vessels and at light stations, such provision will add materially to the efficiency of the Service and relieve cases of serious hardship now arising. There is provision for retirement of persons incapacitated for duty in the Coast Guard and in the Army and Navy. In the general civil-service retirement law of May 22, 1920, there is provision for retirement for disease or injury not due to vicious habits after 15 years' service. Persons coming under the act of June 20, 1918, are the only ones in the military or civil service of the Government to whom some such provision does not now apply, and legislation is needed to remedy this. Some other modifications should be made in the Lighthouse Service retirement law.

EXTENSION OF MEDICAL RELIEF FOR LIGHT KEEPERS.

Light keepers are now entitled to medical relief at hospitals and stations of the Public Health Service. These hospitals are, however, inaccessible for a large number of light keepers who are stationed at remote or isolated points. Equal benefits should be extended to all light keepers, and legislation is needed to provide medical relief for all, and this has been concurred in by the Secretary of the Treasury.

OTHER MEASURES FOR RELIEF OF PERSONNEL.

Legislation is needed to permit the adjustment, within a moderate amount, of claims by lighthouse employees for loss or damage to personal property, such as clothing, furniture, etc., caused by storms, collisions, or fire at light stations, depots, and on vessels. Legislation is also needed to give to corresponding employees of the Lighthouse Service certain necessary privileges now accorded by law to similar services, including the purchase of commissary supplies, transportation of families of employees ordered to permanently change station, and transportation on Army transports.

PROTECTION OF AIDS TO NAVIGATION.

Legislation is needed for the better protection of aids to navigation. Such aids, especially those located in the water, are often damaged by passing vessels, and it is difficult in many instances to locate the party at fault. More stringent requirements are necessary as to failure to report such injuries, etc. Sums received in payment for such damages should also be made available for repair of aids.

MILITARY STATUS OF OFFICERS AND EMPLOYEES TRANSFERRED TO THE NAVY OR WAR DEPARTMENT IN A NATIONAL EMERGENCY.

All persons so transferred should have a suitable military status and be entitled to all relief provided by legislation for those in the military services. A statement on this subject is given in the report for 1919, page 165.

COAST AND GEODETIC SURVEY.

NEED OF A MODERN BUILDING.

This Bureau occupies quarters that are a disgrace—insanitary and directly responsible for a clear loss of 25 per cent efficiency, not to mention the fact that it has far outgrown such quarters as it now occupies. The absolute necessity for modern and healthful quarters with a chance for expansion is a daily problem.

1. The Bureau is housed in five different buildings, but one of which is designed for its needs.

2. Employees under the direct supervision of chiefs of divisions and chiefs of sections are necessarily hundreds of feet away from the directive head, and communication is only possible through a labyrinth of stairs, halls, and bridges.

3. Original field records made at a cost of thousands of dollars are continuously exposed to destruction by fire.

Aside from the disturbing elements under which the Bureau is conducting its work in the Washington headquarters, there is a constant menace to the quarters of the Bureau by fire. The Bureau should be housed in a fireproof building, or certainly one more nearly fireproof than the present buildings. Gasoline, benzole, alcohol, ether, and other explosives are necessarily used in photography and plate-printing work. Although every precaution possible is taken, there is a constant dread of what might happen should a fire start under favorable conditions, as there is so much inflammable material in those old buildings that they would certainly be absolutely destroyed should a fire get much headway.

Incipient blazes have started from various causes, such as overheated steam pipes, spontaneous combustion from oily rags, crossed electric wires, etc. Every precaution is taken, even to the extent of putting oily waste in containers partly filled with water and removing accumulation from the buildings at the close of each day, and keeping explosives such as gasoline, benzole, ether, etc., in automatically closing containers. However, it is in all probability merely a question of time under present conditions when there will be a disastrous fire. The consequences of such a fire are appalling to contemplate. On the original field records of the Bureau are based the data that are contained on every nautical chart of the navigable

waters of the United States and possessions. Likewise, on the original field records in those buildings are based the triangulation and leveling controls of the interior of the entire country. The Coast and Geodetic Survey is the only institution of its kind in the country, and its work is duplicated nowhere else. Therefore, with the destruction of its original records are destroyed the results of more than 100 years of continuous effort by the scientific men who have contributed toward the development of surveys that are the most precise in the world. When these records are destroyed they can only be reproduced by actual resurveys in the field, and so accurate must they be that progress is necessarily slow. It would take years to again build up basic and original data sufficient to use to produce charts and standard controls for mapping the country.

In brief, the Bureau has necessarily expanded to meet the official and public demands that have been made on it for its product, hydrographic charts, nautical publications, and geodetic publications. This expansion has now reached the point where it is absolutely impossible to go further in its present quarters. Where the restriction on the proper operating and administrative work of the Bureau is so pronounced, it is no longer a problem as to how best to do some things, but a problem as to how to do them at all. Records that are consulted constantly are not readily accessible. Intercommunication between the chiefs of divisions and chiefs of sections, as well as employees, is possible only at a great inconvenience and at an absolute waste of valuable time. There is a constant menace to the valuable public records stored in the building through fire. It is impracticable to provide elevator service, though the buildings are five and six stories high, because the buildings are so separated that a single elevator would serve but one building. The buildings are so cut up that it is necessary to devote more than the average amount of space in them to halls and bridges between buildings, so that nearly one-fifth of the area of the buildings is used for these purposes. The point has been reached where the cost in the loss of time and efficiency, to say nothing of the dangers through fire to valuable records, is far more than would be the interest on the investment were a proper building constructed for the Bureau.

SALARY READJUSTMENTS NEEDED TO PRODUCE AN EFFICIENT AND PERMANENT PERSONNEL.

If the Government work is to progress as it should, the Government must provide pay for its employees that will permit at least the ordinary comforts of life and some provisions for old age. The average pay of the Government worker under existing economic conditions does not permit this. The entrance pay is generally too

low to attract applicants, especially efficient applicants. The result is that in the lower grades there is a continuous turnover and a very large number of temporary employees. This condition puts a direct burden on the whole organization, in that the time of the seasoned employees is constantly consumed in instructing the new temporary employees. Further, under present economic conditions the Government organization is becoming weakened, due to the fact that the entrance pay in the Government service is relatively lower than elsewhere. Consequently the Government secures only those who are unable to meet the competition where the entrance pay is higher. This brings into the Government service many who will never fit themselves for larger responsibilities. The result is, at least in this Bureau, that there are numbers of low-paid employees. This condition has been brought about by the very low entrance salary and the necessity of filling the positions permanently by the appointment of those best fitted for the work, though it was known that they were not up to the standard that should be maintained. Experience has proved that work is more efficiently and cheaply done by a fewer number of relatively well-qualified employees than by a larger number of lower paid inefficient employees. Even the efficient employees who came into the service before the war and who have proved their worth are very much dissatisfied with present conditions.

Outside the Government service the salaries have steadily increased to meet the increased cost of living, but within the Government service the statutory salaries have remained about the same, with the exception of the relatively inconsiderable bonus of $240 per annum. The administrative officer in the Government service who is zealous that a high degree of efficiency shall be maintained is constantly face to face with the fact that the employees under his supervision are not adequately paid, and that he dare not force the issue by demanding results that the Government should ordinarily expect, because to do so would be to drive those employees from the service, only to be replaced by less experienced and less competent employees. The outcome is a compromise in a not too rigid exaction of results, a condition in which the morale of the whole organization suffers and a laxity of discipline which will be harder to overcome the longer it is allowed to continue. Yet the administrative officer has but one or the other of two courses open to him. He can exact the services that should be rendered under ordinary conditions and have a continuous turnover of dissatisfied employees or he can lower the standard of duties required to meet the salary scale provided by the Government and retain fairly continuously the employees who receive intermediate salaries. The

entrance grades are never continually filled either by permanent or temporary employees.

During the fiscal year of which this report is presented there were 34 statutory places provided for computers in the Bureau; 23 of these places were filled permanently at the close of the fiscal year, and there had been 23 separations from this roll during the year, or a turnover of 67 per cent. Thirty-six statutory places were provided for draftsmen; 23 of these places were filled permanently at the close of the year and there had been 7 separations from this roll during the year, or a turnover of 19.4 per cent. Forty-two statutory places were provided for clerks; 34 of these places were filled permanently at the close of the year and there had been 15 separations from this roll during the year, or a turnover of 35.8 per cent. Thirty places were provided for messengers and laborers; 28 of these places were filled permanently at the close of the year and there had been 18 separations from this roll during the year, or a turnover of 60 per cent.

The inadequacy of the existing salary scale in the engraving section is striking. The youngest engraver in the Bureau has had 10 years' experience, and the others have been working at engraving from 11 to 61 years. Their basic salaries range from $1,000 to $2,500.

Older engravers have no encouragement to offer their sons or friends who would like to learn chart engraving; the grade of apprentices on the register has become lower and lower and now the Civil Service Commission has no eligibles at all.

It is apparent that no young man of ability will seek employment at work which takes years to learn and where he is almost absolutely under the control of his employer, when he feels that he will not receive the same relative treatment given others whose profession requires no longer to learn and whose chance of employment is not confined to one employer.

As the Government alone makes charts, a corps of engravers is the most permanent force we can have. The engraver, however, has to be trained and must feel that his pay will be adequate to the time required to learn his profession.

We have reached the point where young men of the required ability are no longer seeking engravers' positions, and engravers of over 30 years' experience are resigning.

HYDROGRAPHIC WORK.

Operations in progress July 1, 1919, are taken up, beginning with the wire-drag parties along the New England coast, enumerating the operations consecutively on the Atlantic, Gulf, and Pacific coasts.

A wire-drag party was engaged on the New England coast between Boone Island and Cape Porpoise, Me., dragging the coast area from

inshore out to the 40-fathom curve; also a wire-drag party was employed in Block Island Sound completing the work in that locality in an effort to drag the entire area and closing up gaps in the drag work at the eastern end of Long Island Sound. The work was carried on continuously until the approach of winter weather made it no longer practicable to operate in that vicinity, after which the launches and equipment were stored at Fairhaven, Mass.

Offshore surveys were carried on during the summer by the steamers *Isis* and *Bache* at the entrances to Delaware and Chesapeake Bays, respectively.

The steamer *Onward* accomplished the complete survey of the entrance to Doboy Sound and various detached surveys in Hampton Roads. The vessel then took up work in Adams Creek and the Neuse River, where she is now employed.

The steamer *Hydrographer* was employed continuously on the outer Florida Reefs; also in extending the inshore hydrography out to the 100-fathom curve in the vicinity of Miami, Fla.

The steame *Bache*, on leaving the work in the vicinity of the entrance to Chesapeake Bay, proceeded to the mouth of the Mississippi River and made search for reported shoals off the Mississippi Delta. Sufficient data were obtained to disprove the reported existence of such shoals. Upon completing this work offshore hydrography in the vicinity of Pensacola was taken up and a large area completed out to the 100-fathom curve in cooperation with work of the steamer *Ranger*. On June 16 the *Bache* returned to the offshore surveys in the vicinity of the Delaware capes and is now engaged upon this work extending it northward to Sandy Hook.

The steamer *Isis*, upon suspending work in the vicinity of the Delaware capes, proceeded to the Florida coast near St. Augustine. The vessel having struck a submerged object during the progress of her work, was beached south of St. Augustine and no further work has been accomplished in this area.

The steamer *Ranger* cooperated with the *Bache* in extending the surveys as previously stated out to the 100-fathom curve in the vicinity of Pensacola and has been employed continuously on this work to date.

On the Pacific coast the steamer *Surveyor* left Seattle July 9, 1919, for Shelikof Strait, Alaska, and was employed in combined operations during the summer season of 1919. The vessel returned again this year to the same locality and is extending the hydrographic surveys from Shelikof Strait to the westward.

The motor vessel *Natoma* arrived at San Francisco July 27, 1919, in advance of the Pacific Fleet in time to comply with a request from the admiral commanding for a hydrographic examination of Bonita Channel as a precautionary measure for the safety of the fleet enter-

ing the bay, after which she was employed upon revision surveys of the bay. The work progressed continuously to July 15, 1920, at which time the *Natoma* proceeded to San Pedro, Calif., in order to make a hydrographic revision survey of the outer harbor, as requested by the Navy. The vessel is now employed upon this work.

The steamer *Lydonia*, arriving at San Francisco from the east coast in October, 1919, was employed during the months of November, December, and January on offshore work in the vicinity of Cape Mendocino. The vessel left for Alaska May 26, and has been engaged upon combined operations northward from Dixon Entrance along the outer coast of the Alaska Archipelago.

The steamer *Wenonah* arrived at San Francisco July 31, 1919, and took up hydrographic work in the vicinity of Cape Mendocino. In connection with this work there was developed the uncharted submarine valley reported northwest of Cape Mendocino. A party from the vessel also completed a detailed hydrographic survey of Humboldt Bay. On July 7, 1920, the vessel sailed for Alaska, and has been employed to date upon the survey of the south end of Clarence Strait. This work will include a wire-drag survey in the vicinity of Cape Chacon and Nunez Rock.

During the winter of 1919 and 1920 wire-drag surveys in Lake Washington were in progress. This work was carried on in cooperation with the work of the United States Army Engineers in removing trees from the sunken forest along the southeast shores of the lake. A revision survey was also made of Lake Union. Upon the approach of spring this work was suspended and the party proceeded on the steamer *Explorer* to southeast Alaska and has been employed upon wire-drag work in Stephens Passage, extending the wire-drag surveys along the principal commercial route between Dixon Entrance and Juneau, Alaska. Good progress has been made on this work during the past season.

The following detached parties have been in operation during the past year:

The topographic party employed in a detailed topographic survey in the Virgin Islands succeeded in completing about 90 per cent of this work up to April 7.

On the Pacific coast a party was employed upon triangulation and signal building in the vicinity of Cape Mendocino. This work was carried on with a view to establishing large signals for use in connection with the hydrographic work in that vicinity.

On May 18 a detailed survey of the entrance to Umpqua River was taken up and subsequently extended as far as Reedsport.

Combined surveys in the Philippine Islands have been carried on continuously during this year, four vessels being employed upon the

work under the direction of the officer in charge of the Manila field station.

GEODETIC WORK.

Every effort has been made during the year to extend the fundamental control into those areas of the United States which have not previously been supplied with control points. The fundamental control consists of longitudes and latitudes of monumented stations and azimuths of lines determined by precise triangulation or precise traverse, and elevations of bench marks established by precise leveling. On these geographic positions and elevations detailed control surveys are based which are used in practically all extensive surveying and mapping operations by the several bureaus of the Federal Government carrying on such work, by States, counties, cities, and private organizations and individuals.

This geodetic control has not been carried on in the past with such rapidity as is necessary to meet the demands of the various organizations, Federal and otherwise, mentioned above. The geodetic work of the Coast and Geodetic Survey bears the same relation to the other surveying and mapping activities of the country that the steel framework of a large building bears to the various detailed portions of the building. It is essential in the interests of economy and efficiency that this geodetic work be extended more rapidly with the idea of having fundamental geographic positions and elevations within short distances of all parts of the country at an early date, in order that detailed surveying and mapping operations by various Federal and other organizations may have easily accessible starting points for their work. It is also essential not only that geodetic work be carried on throughout the United States, but it should also be extended into the interior of Alaska, where no fundamental control has been established. It is hoped that Congress will make substantial increases in the appropriations for all the geodetic work of the Coast and Geodetic Survey.

During the past year the most important pieces of geodetic work undertaken in the country are the following:

Triangulation and precise leveling from the vicinity of Mount Shasta, Calif., northeastward, through Oregon, to the vicinity of the town of Ontario, Oreg. This work was requested by the officials of the United States Forest Service and of the United States Geological Survey for the fundamental control of surveying operations by those organizations within the area covered.

A line of precise levels has been extended from Santa Ana, Calif., northward to Tacoma, Wash. This line is not only useful in furnishing fundamental elevations through the three States traversed, but it will coordinate much detailed leveling that had been done pre-

viously by various governmental and other organizations within those States.

Primary triangulation was carried from the vicinity of Nogales to Yuma, Ariz., just to the northward of the Mexican boundary. This was a very difficult piece of work, owing to the scarcity of water and supplies which have to be hauled long distances. This triangulation was requested by the Office of the Chief of Engineers of the Army.

In order to fill in a space badly in need of geographic positions and to furnish control for surveys by the Forest Service in some of their reservations, primary triangulation was extended northward from the vicinity of Tuscon to Grand Canyon, Ariz., and from Williams, Ariz., to Albuquerque, N. Mex.

Precise leveling and precise triangulation and traverse were extended from the vicinity of Waco, Tex., to the vicinity of Naples, La., on the Mississippi River. This work was done at the request of the Office of the Chief of Engineers, United States Army.

A line of precise traverse was extended north and south through the State of Indiana, a similar line was extended north and south through the State of Illinois, and a line of precise levels was run through the State of Illinois, to furnish fundamental control for detailed topographic mapping which the United States Geological Survey is carrying on in those States. This work was specifically requested by the Director of that Bureau.

A number of other projects were undertaken during the year which were of much smaller extent than those mentioned above.

In the office of the Coast and Geodetic Survey the results of geodetic field operations were put in final form and prepared for printing in so far as the limited force of the division of geodesy would permit. It is important that the results of the various activities of the surveys in the field should be made available to the public as soon as possible after completion of field work. In order that this desirable work may be accomplished, the office force of the Survey should be strengthened.

INCREASED APPROPRIATIONS FOR CONTINUING GEODETIC OPERATIONS.

By Executive order dated December 30, 1919, there was created a Board of Surveys and Maps of the Federal Government. The work of this board bears such close relation to the work of the Bureau, and will doubtless have such an influence in shaping its activities in the future, that this subject would be incomplete without some mention of the purposes and aims of the board.

It is believed that the creation of this Board of Surveys and Maps is a step that will have very far-reaching consequences in the hori-

zontal and vertical control, the topographic mapping of the country, and in planning standard methods to carry on the work connected with surveying and map making of various kinds done by Government organizations and by private organizations and individuals. Maps have been made in this country ever since the colonists first landed, but there has never been any coordinating agency by which standards of accuracy would be established for the guidance of surveyors and map makers.

The Coast and Geodetic Survey has, as one of its main functions, the establishment of fundamental horizontal and vertical control along the coast and in the interior of the United States. The stations of the control surveys, both horizontal and vertical, are for the primary purpose of forming the basis for the various classes of surveying and mapping and to fill other engineering needs. They are especially valuable for the standard topographic surveys of the United States Geological Survey, the military surveys of the Army, international, State, and boundaries, and engineering and surveying work for highways, railroads, and cities.

The rate at which the precise horizontal and vertical control has been done during the last 10 years is far greater than has been the case formerly. This is due to somewhat larger appropriations and also to greater efficiency and skill in the executive and technical work involved. The slowness with which the geodetic work has been extended in the country for the last half century is due almost entirely to the lack of appreciation of the necessity for fundamental control by other organizations of the Government, by States, cities, and by private organizations and individuals. The officials of the Coast and Geodetic Survey have continually placed the problem before Congress and urged a greater appropriation for this work. The demands are becoming so urgent on the Survey that it is believed far greater appropriations should be made now in order to meet public needs.

DIVISION OF TERRESTRIAL MAGNETISM.

The reduction of the work of the Honolulu magnetic observatory for 1917 and 1918 was completed and the results were submitted for publication. At the end of the year results for the same period for the Sitka and Tucson observatories were ready for publication, except for the preparation of tracings of the principal magnetic storms, and the reduction of the Porto Rico work nearly completed. The reduction of the Cheltenham results was delayed until the conclusion of the investigation of the difference between the records of the two H variometers.

The results of magnetic observations made in Alaska up to the end of 1918 were published as "Alaska Magnetic Tables and Mag-

netic Charts for 1920," Special Publication No. 63. This includes secular change tables and charts showing the lines of equal magnetic declination, dip, and horizontal intensity.

The earthquakes recorded at the five magnetic observatories have been tabulated monthly and the results have been published in the Monthly Weather Review and transmitted to the International Seismological Association and others engaged in a comparative study of earthquake data.

Chapters on terrestrial magnetism and seismology were prepared for the new edition of Special Publication No. 23, and the chapter on terrestrial magnetism in "General Instructions for Field Work" was revised.

An extended series of observations was made, in cooperation with the division of geodesy, to determine the magnetic properties of the new invar pendulums and the effect of the earth's magnetism upon their time of oscillation.

A test was made as to the practicability of using a planimeter for reading the hourly ordinates from magnetograms.

An investigation was made of the accuracy of the time scales of our seismographs, which showed that in most cases a better time-marking clock is needed. The experience with a chronometer at Tucson indicates that the needed improvement can be secured in that way.

Compass data were supplied for 165 charts.

MAGNETIC OBSERVATIONS.

In the continuation of the magnetic survey of the United States observations were made during the year at 79 stations in 22 States, of which 24 were primary stations, 11 auxiliary stations, 42 repeat stations for the determination of secular change, and 2 new stations in old localities. Meridian lines were established when they were requested by the local authorities.

The observatories at Cheltenham, Md., Vieques, P. R., Tucson, Ariz., Sitka, Alaska, and near Honolulu, Hawaii, were in operation throughout the year. A continuous photographic record was secured of the variations of declination, horizontal intensity, and vertical intensity. Absolute observations were made at least once a week. A seismograph was in continuous operation at each observatory.

ALASKA NEEDS IMMEDIATE, DEFINITE, AND ADEQUATE RELIEF.

Alaska has had much written about her—our great frontier country with its 26,000 miles of coast line—but there has never been a well-defined and concentrated effort on a big-business scale to develop the Territory as it should be done. For 53 years we have gone along

giving this vast and rich empire a "dab of paint" here and there, but no definite policy has ever been suggested that has been fully and comprehensively carried out. The result has been much complication and continued neglect.

The Coast and Geodetic Survey is a very interested and vital agency in the safe development of Alaska. It can be said with no fear of being contradicted that on this arm of the Federal Government rests, and properly should rest, the responsibility of erecting the steel structure, so to speak, in building up this great Territory.

It is peculiarly appropriate in the proper development of any frontier territory to look to the safeguarding of its people, and the safety in erecting the foundation paves the way for future success.

Alaska, with its more than 26,000 miles of detailed coast line, can not be approached without plying the waters that nearly surround it. On the east are gigantic mountain ranges that may never be surmounted by railroads. Therefore the only means to get to Alaska is by means of ships to her seaport towns. It thus follows that the protection of these vast water areas by the most careful surveys in locating hidden dangers is the essential step in the Territory's proper development. Alaska's waterways are her gateways and her highways of commerce, and certainly the first protection should be given these before the coast or interior can have its proper development.

It will be interesting to know, however, that in 53 years we have had to spend in Alaska on this work only $4,067,578, or an average annual expenditure of $78,223. The appropriation in 11 years for the construction and maintenance of military and post roads, bridges, etc., for the interior of Alaska, has been $2,120,000, or an average annual appropriation of $192,778. Congress has appropriated $48,000,000 for a Federal Government railroad from Seward to Fairbanks. These figures are not given in a spirit of criticism, but simply to show what a small proportion the Coast Survey has had, which has resulted in a great retardation of the work that should invariably precede development of a new country. In comparison with the amounts given for these other two objects it is a mere pittance.

The Survey has had a difficult problem to contend with in this half century's work in Alaska. It has been sorely handicapped with vessels that were in most every instance not adapted to the work in Alaska, and unable many times to cope with the unusual weather conditions of that region. Many times the officers and crews of these craft have had to cease operations and seek harbors of refuge from storms, which often put not only their lives in actual jeopardy, but the vessels as well.

The exports from Alaska for the last 53 years have amounted to about $943,000,000, reaching a high-water mark the past year of about

$94,709,359, and this does not include, of course, the great amount of fish, lumber, and other products of the Territory consumed by its population.

The imports to Alaska for the past 53 years have amounted to $547,400,000, reaching the high-water mark in 1918, $146,020,124. These figures are to show briefly the enormous amount of shipping necessary to handle this large amount of trade.

For the first 30 years after the purchase of Alaska by the United States a few small vessels only were required for the commerce betwen Alaska ports and the ports on the Pacific coast of continental United States. In 1919 there were over 4,000 vessels with a tonnage of over 2,000,000 entering and clearing Alaska, but instead of having vesels of 10 or 12 feet draft, as were the earlier ones, we now have them up to 28 feet. In other words, when the work of the Coast and Geodetic Survey is at its lowest ebb there, Alaska's prosperity is greater than ever before.

Few people realize or even think of the Territory's enormous area. From Dixon Entrance, on the international boundary line, to the farthest Attu Island it is nearly 3,000 miles. Along this stretch of coast there are about 465 islands in Alaska containing one or more square miles, and innumerable smaller ones. The longest island is Prince of Wales, 131 miles long and 39 miles wide, while Kodiak Island has the largest area, 101 miles long and 63 miles wide—equal to the combined areas of Connecticut and Rhode Island.

The total area of Alaska is 586,400 square miles, or nearly twice the size of the original 13 States of the Union. To this we can add 7 other States east of the Mississippi River, and still we do not have the area of Alaska. Norway, Sweden, Finland, England, Scotland, and Ireland do not contain as much territory as Alaska. Germany, France, and Spain have only a trifle more area than this Territory.

MANY UNDEVELOPED HARBORS OF ALASKA.

Unlike the waters adjacent to the States bordering on the Pacific coast, Alaska has many fine harbors, and except a stretch beginning at Cross Sound in southern Alaska and extending to Controller Bay, Prince William Sound, south central Alaska, a distance of 275 miles, where there is only one harbor of refuge for vessels (Yakutat Bay), over the many miles of Alaska's coasts nature has provided bountifully for ships and shipping in splendid harbors.

In this respect the south coast of Alaska resembles Norway and Sweden, her harbors being so numerous as to meet every demand for the future development of the entire Territory. In Bering Sea, northward and eastward of Unimak Pass, the harbors are not so plentiful and are characterized by shoals in the approaches. This

makes it specially necessary that accurate surveys be made in order to permit safe navigation. It is remarkable how little accurate knowledge is available in connection with the many bays adjacent to the mainland, and more especially about the many islands of Alaska. Not until these are properly safeguarded can it be hoped that they will be properly or permanently developed.

With the great demand for paper and substitutes for wooden boxes, the country is looking to Alaska for the supply of raw materials. Never in the history of Alaska has there been such a centering of interest on these important products that have been so scarce and in such demand in the past two or three years. One of the first conditions looked for by those who are interested in building paper mills or factories are good harbors and cheap power. Alaska abounds in both. Hundreds of harbors adequate for the carrying of large vessels and conducting manufacturing plants are in southern Alaska, and in close proximity to many of them is wonderful water power that is only waiting to be put to proper use. The anticipated development along these lines is about to be realized, but the principal forerunner for encouraging this development is to safeguard the waterways by completed surveys. In very few instances is this done. Now the demand by the public for surveys of many of these harbors is being made, and to prevent further delay it would require vessels, more men, and sufficient money to bring about the imperative initial step to this very important commercial development.

HOW LITTLE THE PRESENT CHARTS MEAN TO MARINERS.

An important difference between Alaska waters and those of the continental United States is that scarcely enough work has been done to let us know just how much must be done to complete the charts. It is estimated that *90 per cent* of the water areas of Alaska are unsurveyed or insufficiently surveyed. The development of the country has far outstripped the progress of surveys, not only because of the few vessels and parties engaged in the work but because of the great length of coast over which the various activities are scattered and the intricate system of channels for so much of its extent.

In order to appreciate the need of rapidly extending surveys of these waters, it should be clearly understood that Alaska's only connection with the rest of the world is by the water routes.

The Government railroad now being built and the other existing lines are not trunk lines in so far as connection with the continental United States and Canada are concerned. The trunk line is the waterway from various ports in Alaska to Puget Sound and other west-coast ports. The Alaska railroads and local steamboat lines are feeders only. The industries, which include chiefly mining of

gold and copper on an immense scale and of various other minerals to a less extent, fisheries, especially salmon canning, but also supplying halibut and other fish to the market, and agricultural grazing (now of minor importance but developing), are scattered everywhere, and connection with the principal ports is by boat. The principal towns are on good harbors suitably located with reference to the steamer routes and the more important lines and canneries, and any town that loses any of these advantages soon declines in importance. In practically all cases the canneries and mines along the shores are visited directly by steamers.

The amount of these natural resources ripe for exploitation has been so great and the prize they offered so tempting that transportation could not wait for the Government to make the way to them secure. It has gone ahead, finding its own path to each new field, suffering great losses in doing so, but content to suffer them because the returns were so immensely greater.

WHAT THE TOLL HAS BEEN IN WRECKS.

It is impossible to give an accurate list of hundreds of vessels that have stranded, foundered, and been total wrecks in the waters of Alaska during the past 53 years. The records, which have been somewhat neglected, especially in the earlier history of this comparatively new possession of the United States, are anything but complete, but they are sufficiently known to convey to the minds of those who are interested a most harrowing condition that has existed during the last half century. While it should not be understood that all of these disasters have been caused by lack of proper sailing charts and lack of knowledge of currents, it can be said that the greater portion of the wrecks have been directly due to the lack of accurate nautical information which can be furnished by proper surveys.

Accidents to vessels in Alaskan waters have caused the loss of hundreds of lives and property to a value not far from twenty millions, and which would represent to-day, with the high cost of shipbuilding, at least 50 per cent more. It will appeal to many as a matter of very poor economy that there is so little protection given to human life and vessel property employed in building up this truly great and remarkable empire of the United States.

From 1867 to 1919 there have been approximately 438 vessels wrecked in Alaskan waters, with a loss of about 950 lives. Among these vessels were large sailing craft as well as freight and passenger vessels, also some Government vessels. When we stop to think for a moment of this enormous loss and consider alone that the National Government has suffered the loss of three splendid vessels

worth more than a million dollars, the serious side of the question is emphasized, especially when we think how much could have been done with this money if it had been applied in surveying the waters of Alaska.

WHY UNSURVEYED WATERS RETARD ALASKA'S DEVELOPMENT.

The history of the industrial development of Alaska shows that, almost without exception, the establishment of industries and commerce has preceded rather than followed the surveys of the locality, and that their establishment and development have been greatly retarded and oftentimes entirely suspended by the lack of such surveys. The following cases are given to illustrate these conditions:

Deposits of excellent marble were discovered in Davidson Inlet, and a company was organized to quarry the rock and ship it to Seattle. However, as the approaches to the quarry were incompletely surveyed, the steamship companies refused to send their vessels there, and thus denied the transportation, the marble company was helpless. Finally, one of the steamship companies sent one of its pilots to the locality to report on the feasibility of sending in vessels in advance of complete surveys. The examination made by this pilot revealed so many uncharted dangers in the approaches that the company demanded a prohibitive price for permitting its vessels to enter. The Coast and Geodetic Survey was appealed to, and in 1913 the Survey steamer *Explorer* made a detailed survey of the harbor and its approaches. The result of this survey, while confirming the dangers previously reported by the pilot, developed a practical channel through them, with the result that large quantities of marble are now being shipped annually to Seattle.

An outcropping vein of gold-bearing quartz was discovered in Khaz Bay, on the west coast of Chichagof Island. Development work, begun immediately, showed the claim to be a rich one; portions of the uncovered vein showed nuggets and wires of free gold, and assays made of certain choice samples showed the gold contents running as high as $2,200 per ton of ore. Yet, rich as was the vein, the owners were helpless to profit from it. The mine was at the head of a small bay which, with the waters leading to it, was unsurveyed, but known to be foul and dangerous; vessels passing along the coast could see large areas of reefs with jagged rocks showing above the surface. Therefore the steamship companies refused to send in their vessels, to bring in mining machinery or to carry out ore, except at a prohibitive cost.

COMPLETE SURVEYS NEEDED.

Because of the rapidly increasing commercial importance of Alaska, it is imperative that the present conditions as regards survey

work be remedied by means of complete surveys, carried on in a systematic manner and extended with all possible rapidity.

In order to appreciate the immediate need for this work, it must be clearly understood that Alaska's only connection with the rest of the world is by water routes. The millions of dollars that are being expended to build the Government-owned railroad to the interior of Alaska; the large amount of private capital that has been and will be spent to develop her mines, to build up her fishing industry; the certain early opening of the vast coal fields; the utilizing of the great timber resources, etc.; all this would be wasted and her vast resources would be worthless if vessels could not reach and enter her ports or visit the railroad terminals, canneries, and nearest ports as outlets to the many mines.

And it is a fact, at the present time, there are few passages that can be navigated and few harbors that can be entered by a vessel with the assurance that the near-by shore line and landmarks and the contour of the bottom over which she is traveling are accurately shown on the charts, or that the hidden dangers that may lie in her path have all been discovered and charted.

That, in the past, instead of blazing the trail for water-borne commerce, the Coast and Geodetic Survey, because of lack of funds and essential equipment, has been forced to lag behind is as deplorable as it has been unavoidable. The time has now come, however, when we must face the issue squarely and realize that the interests of commerce, passengers, shipowners, navigators, and those who have invested their capital in Alaska's industries must be safeguarded by adequate surveys prosecuted vigorously and on a much larger scale than heretofore. Even then it will take years before the surveys can reach a point where they can meet the present needs of commerce; and it must not be overlooked that the time is not far off when our naval vessels will frequent Alaska's waters in numbers.

Scarcely enough work has been done at the present time to give an accurate idea of the amount of survey work that will be required. The following, however, may be taken as a general statement of conditions along this line:

In southeastern Alaska the first and most obvious need is to complete the surveys and wire-drag work. The larger part of the steamer routes has been fairly well sounded, so that only dragging is necessary to complete the survey. The importance of wire-drag work in this locality and in other parts of Alaska will be discussed under a separate heading.

In all other regions only scattered surveys have been made. Complete hydrographic and topographic surveys must be made of all passages, bays, and harbors. In practically every case this work must be supplemented by wire-drag surveys, and many localities

in which the ordinary hydrographic surveys have already been completed must be dragged.

On the outer coasts soundings must be extended for a sufficient distance to enable the navigator to determine the distance of his vessel from land in thick weather by use of the lead, and to fully develop the great fishing banks, which are among the most extensive in the world. On the outer coasts wire-drag surveys will be required only at critical points and in the approaches and entrances to the numerous sounds and passages.

MODERN VESSELS NEEDED.

In the preceding pages it has been the desire to give a clear idea of the present conditions in Alaska as far as they relate to its coast surveys. It is the present purpose to consider the means at hand and those that are needed to bring these surveys to such completeness that the loss of vessels can not be ascribed to lack of reliable charts and sailing directions.

In the past the Bureau has been inadequately equipped for this work, but conditions are at their worst now, when the commerce of Alaska exceeds anything in our history and is increasing by leaps and bounds. Since the Government is spending vast sums to provide a merchant marine, it is "good business" to take normal precautions that these vessels may safely navigate our waters.

Personal observation of these conditions was made in a number of instances this year. Companies were anxious to get machinery across unsurveyed waters, and the necessity of shipping products out of Alaska was retarded and in some cases nothing was accomplished, as the steamship companies absolutely refused to risk going into waters not properly charted and will continue to do so until the waters are made safe for navigation.

Take the town Ketchikan. Where a general survey in the immediate vicinity of the original docks was sufficient a few years ago, now a mile north of the town, a closer survey on a larger scale is very much needed. Ten times as many docks have been built, but steamers will not stop to pick up exports or bring in supplies while the chart information is inadequate to protect their vessels.

The natural resources of Alaska have so tempted commerce that vessels have ventured into those regions far in advance of adequate surveys. The means of the Coast and Geodetic Survey for charting Alaskan waters have been and are so limited that the best that could then be done and can now be done is to shift from place to place and make examinations where industry has preceded surveys and dangers have been found by vessels striking them, or where industry has established itself and demands a local survey.

The equipment for these surveys is so limited that no definite plan can be laid for their ultimate completion or for the issuing of charts that will be guides to all parts of Alaskan waters.

The making of surveys and supplying of reliable charts for the urgent needs of Alaska is a question of the number of surveying vessels and wire-drag launches available for the work.

IMPORTANCE OF WIRE DRAG.

Ordinary hydrographic surveys are made with a launch or other vessel, which proceeds back and forth across the area to be surveyed until the entire area is covered by a system of sounding lines, usually parallel. The distance between the sounding lines depends on the depth and nature of the bottom and the importance of the locality. As the boat follows these lines, the depth of water is obtained by means of a lead and line, cast at intervals from the boat. Such surveys must be made in all regions in order that the contour of the bottom beneath the surface of the water may be known, and along the sandy portions of our coasts surveys by this method may be sufficient.

This is decidedly not the case, however, in regions where there are obstructions of small area, such as pinnacle rocks, bowlders, and sharp rocky ledges, for it is only by chance that they can be found by an ordinary hydrographic survey. It is difficult to explain just how elusive these dangers are when sought with the hand lead. Let us consider, as an analogy, a balloon drifting slowly over a town. Imagine the difficulty of throwing a weight attached to a line and hitting the top of a church spire or the gable of a house as the balloon passes over them, and remember that the hydrographer not only can not see the obstruction beneath the surface but does not even know that it exists.

It has therefore been necessary to supplement ordinary hydrographic surveys by some means of finding all of these dangers in regions where they exist, and for this purpose the Coast and Geodetic Survey uses an apparatus known as the wire drag. Starting on the Atlantic coast in 1904 with an apparatus patterned after the wire sweep used at that time by the United States Army Engineers on the Great Lakes, the Survey has gradually developed and perfected equipment and methods of operation until at the present time the modern wire drag is a wonderfully efficient mechanism, capable of covering large areas rapidly and finding therein every danger to navigation that exists.

Stated briefly, the wire drag consists of a horizontal wire maintained at any desired distance below the surface of the water by an arrangement of weights and adjustable upright cables extending up to the

surface buoys. This apparatus is towed by two launches, one at each end. As the drag passes through the water it will catch and show the location of any obstruction existing above the plane of the horizontal wire. Knowing the location of the obstruction, the least depth on it can be easily found by sounding with lead and line from a small boat.

That pinnacle rocks, the most dangerous of all obstructions to navigators, are present in Alaskan waters can be easily predicted from a study of the adjoining land areas; and in a few cases such rocks, their existence indicated by kelp extending up to the surface of the water, were discovered by hydrographic parties. With the increase in the commercial importance of Alaska and the number of ships plying its waters came an increase in the number of accidents to vessels, with loss of life and property; and the fact that many of these accidents were due to striking uncharted rocks caused a realization of the fact that not only do pinnacle rocks exist in large numbers, but that they occur in the most unexpected localities. It was, of course, evident that all these dangers must be found in order to safeguard vessels navigating the waters of Alaska, and wire-drag work was accordingly started in 1914. Since that time it has been prosecuted as rapidly as funds would permit.

The startling number of dangers to navigation discovered with the wire drag during the short time that it has been used in Alaska waters strongly emphasizes the fact that in regions where shores are rocky practically all the navigable waters out to the 50-fathom curve must be dragged in order to provide the assurance of safe navigation to which navigators, shipowners, and the general public are so plainly entitled. This is a huge task, but it is imperative that it be prosecuted with vigor and carried to the earliest possible conclusion.

Too much emphasis can not be put on the need of increasing the force for completing the wire-drag survey in Alaska. There is hardly a move made by our vessels that does not indicate that there are pinnacle rocks with great depths of water surrounding them. This can not be permanently or safely done by the usual manner of carrying on hydrographic surveys. To do this economically, quickly, and thoroughly, the launches should be built by the Government to meet the needs of this important and peculiar work. The wisdom of having launches built for the wire drag has been evidenced during the past season when they were a contributing factor in reducing the cost per square mile. The old method of hiring launches is a waste of much time and costs the Government considerably more than it should. It is hoped that several wire-drag parties can be placed in the waters of southeastern Alaska next year.

FIRST SURVEYS OF INTERIOR ALASKA NEEDED.

It would be a mistake to leave the subject of water surveys in Alaska without calling attention to the great need for establishing monuments (survey control points) throughout the Territory and determining their latitude, longitude, and elevation.

1. Along the coast such control points have been established in many localities where hydrographic surveys have been made, but they are not connected with each other or with the other surveys of the United States or Canada. In the interior control points have been located along the international boundary and in a few small areas inland, but all these various regions must be connected in the immediate future to avoid wasted effort, costly later adjustments, and a delay in the development of the country.

There is no place in the territory of the United States where maps are of more value in industries of various kinds than in the interior of Alaska. These maps, of course, should be good ones, and the only possible way to have a good map is to have a properly coordinated and consistent system of control.

The method of determining the geographic positions of monuments which are used for the control points of the topographic maps and surveys of various kinds is triangulation. In this method a base line or distance between two established points is measured, and other distances between contiguous points are determined by computations from this known length and the measured angles of the triangles in the scheme of triangulation. The latitudes of these stations are the distances from the Equator, and the longitudes are the distances from the meridian passing through the observatory at Greenwich.

2. To join these various detached bits of triangulation and to connect the whole of Alaska to the surveys of the remainder of the continent in its proper geographic relation, observations have been begun with the cooperation of the Canadian Government, on a strong chain of triangulation to reach from the vicinity of Seattle through southeast Alaska to the upper portion of the Yukon River where it crosses the Alaskan boundary. From that point lines of triangulation will extend through Alaska over routes indicated in a later paragraph.

After being carried by the Canadians through British Columbia, this scheme of triangulation will lead northward across Dixon Entrance, thence up Clarence Strait, just eastward of Ketchikan, passing to the eastward of Kupreanof and Admiralty Islands, and up Lynn Canal to where the scheme again crosses into Canadian territory.

To that central belt of accurately determined control points will be connected loops of triangulation, which have already surrounded or soon will surround many of the large and important islands in southeastern Alaska, such as Revillagegido, on which Ketchikan is located, Prince of Wales Island, and others which are if vital importance to the development of that portion of Alaska.

Accurate elevations are determined in the interior of a country by lines of precise leveling, which are extended inland from tidal stations. At these tidal stations the relation between mean sea level and some object on shore is determined by long series of observations. The mean sea level is considered to be zero in the leveling net and all other elevations are referred to it.

With the longitude and latitude known for each of a number of triangulation stations and the elevations available for bench marks we have what may be considered a framework upon which detailed surveys can be made. If the area is local and can never be connected by triangulation with any other (such, for instance, as an oceanic island), then extensive primary triangulation and precise leveling are not necessary, but, in an area the size of Alaska, each locality that is the scene of present industry and commerce will undoubtedly be connected by surveys and maps with other localities. If we do not have such a framework as mentioned above, there will be serious discrepancies when two local surveys or maps are joined. There will be offsets, gaps, or overlaps, which will be sources of trouble until the whole work has been properly adjusted to the strong control work that must be done to make the local surveys fit into each other.

It is the experience of all civilized nations that for the economical surveying and mapping of their areas primary triangulation and precise leveling have been required. Many of the countries have followed the surveys and maps by primary triangulation and precise leveling while others have had the control work precede the operations upon which the maps are based. In the United States much of the surveying of the public lands preceded any triangulation whatsoever, with the result that many of the maps have not the proper control.

Surveying is now being done in the interior of Alaska by several organizations of the Government, especially the United States Geological Survey, the General Land Office, and the Forest Service. There are, of course, mineral surveys made also. These organizations are now operating without primary control points, and there is no way of telling just where those local maps and surveys are located, except those that are made near the coast. An approximate position of a survey may be obtained by astronomic observations, but the latitude and longitude of such a survey may be in error by

as much as one-fourth or one-half mile, due to the local attractions of the mountain masses on the plumb line to which all astronomical observations are referred.

A letter from the office of the Commissioner of the General Land Office, under date of September 3, 1920, reads in part as follows:

> A system of triangulation along the Yukon River, especially the upper portion from Tanana to Eagle, will no doubt be of value to us in the near future. We have now pending 50 or more isolated surveys, scattered over this district, and others will follow. With triangulation we could adjust these surveys to the rectangular net and lay a foundation for a uniform system with less possibility of confusion than to dot the country with innumerable isolated surveys.

WHERE CONTROL SURVEYS SHOULD BE MADE.

It would seem to be the most economical method of mapping Alaska to have long arcs of primary triangulation and lines of precise leveling extended throughout the area where maps are being made and where they will be made in the near future. There are some areas which can await the development of the country before the triangulation and precise leveling are done. This control work should be done very soon after opening of a transportation route, but should not in general precede it, as otherwise the work will be excessively expensive.

There is immediate need for a system of primary triangulation down the Yukon River, from its crossing at the one hundred forty-first meridian to the mouth, or at least to St. Michael. A line of precise levels should follow along this same route. Another line of precise levels and an arc of triangulation should be carried up the Copper River from its mouth and on to Fairbanks. A spur should be carried from this system to the one hundred forty-first meridian, at a point about 70 miles north of Mount St. Elias. Another route which should be followed by primary triangulation and precise leveling is along the Alaska Railway, from the head of Cook Inlet northward. The other important work should be done along the Kuskokwim River from its mouth to the Yukon, with a spur line running eastward along the Odgovigamut River. A small piece of work should be done between Cook Inlet and Bristol Bay. Here only triangulation is needed.

The work mentioned above would, it seems, meet all the immediate needs for primary geodetic work in Alaska. It is needed for the interior as well as to strengthen the coast triangulation, which is used to control the sailing charts. The work outlined is, of course, not all that is needed, but additional work can be done and planned as occasion demands.

ALASKA'S IMMEDIATE NEEDS.

Alaska's greatest need should be given serious thought now and not put off for another year. The provision now of a comparatively small amount of money will save added expense in years to come, not to mention the saving in life and property. It is necessary to have the authorization for new vessels and new launches, which is the only way to conduct this work economically from the standpoint of cost for carrying on the work with greater speed.

So important is the matter of the survey of the waters of Alaska that it is deemed a wise business move to establish at Ketchikan, the entering port of Alaska, as soon as funds are available, a permanent station supervised by a commissioned officer of the Coast Survey where the launches of the Survey can be stored in the winter, a vessel kept in commission, and where supplies including coal and fuel can be obtained. It is unfortunate that at the present station in Alaska our vessels are often delayed owing to the fact that Australian coal and Canadian coal are not available for the vessels of the United States. The establishment of this permanent station in Alaska will do much to facilitate matters and help the parties on sea and land to get into the field more promptly in the spring of each year.

ALASKA'S FUTURE.

It is safe to predict, and with proper emphasis, that Alaska will reach out in the near future looking to development along all lines and through every possible channel. Her next 10 years will most likely place her far in advance of what the past 50 years have produced and all assistance possible should be forthcoming from the mother country, upon whom the responsibility rests. We should be well prepared in every branch of the home Government to facilitate the commercial development and competition that will surely follow the close of the war.

Let it be hoped that the day is at hand when it will be no longer necessary to discover uncharted pinnacle rocks by the loss of some vessel, and the custom of commemorating the loss by naming the hidden rock after the unfortunate craft will be impossible in the future.

The Coast and Geodetic Survey, which in this field should have been the pioneer, showing the way for commerce to reach each new enterprise, has instead been following impotently behind, charting dangers less from data obtained by its own surveys than from reports of vessels which have been wrecked on them.

It is high time that such a state of affairs be corrected, yet it will now take years before the surveys can reach a point where they can even meet the needs of the present commerce.

PURCHASE OF DUTCH HARBOR, ALASKA, AS A FEDERAL GOVERNMENT BASE.

In 1914, 1915, 1916, and 1917 the Department strongly recommended the desirability of the purchase of Dutch Harbor, Aleutian Islands, Alaska, as a Federal Government base. Up to the present time, while the wisdom of securing this property has been clearly shown, nothing definite has been done. Dutch Harbor is the old home and village of the North American Commercial Co., where now the Government wireless station is located. The place is practically abandoned. The buildings are in a fair state of preservation. The harbor is excellent and far better and safer for large vessels desiring to dock there than at Unalaska. There is an abundance of excellent water which Unalaska lacks. There are also good buildings for living quarters for various Government officials. There was never a greater need than at this time for a Government base in western Alaska, where coal, fuel, and other supplies can be obtained at any time of the year, which under existing conditions is impossible. The idea of making Dutch Harbor an ideal Government supply station is one that should be encouraged, and the opportunity now presents itself, and if further postponed the opportunity for carrying out this wise business venture may be lost.

FIELD STATION AND BOATHOUSE AT KETCHIKAN, ALASKA.

Since 1898 practically the entire facilities of the Coast and Geodetic Survey on the Pacific coast of the United States have been employed in Alaska in an effort to keep pace with the growing commerce carried on with its coast ports. During the period from 1907 to 1915 three of the Survey's vessels were employed in southeast Alaska in an effort to obtain by means of adequate surveys accurate charts to assist in the commercial development of the country. To assist in this work launches were employed for the development of shoal areas and ledges and to search out intricate areas where the larger vessels could not be maneuvered. A small boathouse on the reservation at Sitka was used to house these launches during the winter seasons, and the naval station at that place was used as the base station for surveying operations up until 1907, when it became necessary to remove the launch equipment to a place more accessible to the working grounds in southeast Alaska. Ketchikan was selected for this purpose and a boathouse constructed at Metlakatla for housing the launches and storing such of the equipment as it was found advisable to leave in Alaska.

In 1914 wire-drag work was begun in southeast Alaska, and from 1915 to the entering of the United States into the World War two parties were employed. The launches used upon the work were

chartered makeshifts remodeled to serve as best they could and were returned to the owners at the end of the season. At the termination of the war relief came in a measure to this very unsatisfactory way of procuring equipment. The Navy supplied the Survey with a number of large launches which were made suitable after alterations for assisting in the wire-drag work.

The additional equipment made it possible to resume survey work with increased activity in southeast Alaska, and the necessity for providing suitable space for housing the equipment at the most advantageous point now presents itself. There are to-day four large steam launches which will remain in Alaska during the winters as it is not practicable to tow them or run them south when the approach of winter weather makes it no longer economical to attempt wire-drag and other survey work. To these will be added during the coming year three gas launches which are now stored in Seattle. The repairs incident to the upkeep of this equipment, together with the repairs to the wire-drag apparatus, can only be accomplished after the close of the surveying season, and must of necessity be completed before the opening of the season in the early spring.

There should be the most serious thought given to the care of this assembled equipment, its upkeep and its apportionment to parties given the task of sweeping the channels with the wire drag and extending the surveys to meet the needs of commerce. With this in mind, and the paramount importance of selecting a site suitable for a base, authorization will be sought for the construction of suitable boathouses, ways for hauling out, and a wharf that can be used by the larger vessels for storing coal and supplies needed in the field of operation. If authorization can be secured, all plans and specifications will be prepared, bids obtained, and the construction begun at once.

The present plans for construction and estimated costs are as follows:

Boathouse with suitable space for overhauling wire-drag equipment, ways, and storing facilities for 13 launches	$15,000
Wharf with 2,000 square feet	5,000
Watchman's dwelling	2,500
Total	22,500

The rapid development of Alaska along commercial lines is well illustrated by the request for surveys and for information pertaining to areas where newly selected sites for proposed industries have been chosen. There are, especially in southeast Alaska, some of the finest water-power sites on the Pacific coast, which have attracted the attention of capital with a view to establishing pulp mills and other industries. The water approach to these sites must of necessity be surveyed, dragged, and the dangers charted. The most important

of Alaska water-power projects at this time, and one which has been developed to a considerable extent, is located at Port Snettisham. It is located in the midst of a well-timbered section and surrounded by other valuable material resources easily accessible. An urgent request for a more complete survey of the approaches to this important site has been received through one of the survey parties now operating in its vicinity.

To keep more closely in touch with the needs for such surveys, it is proposed to establish in southeast Alaska a permanent field station of the Coast and Geodetic Survey. This would enable the public to obtain advance information of the navigable waters where surveys are now only partially completed or totally lacking. With a Survey officer available at such a station, small surveys and examinations could be made at once and much valuable information obtained which would enable commercial interests to locate at points accessible to the passenger and freight steamers plying between Alaska and United States ports.

As the proposed operations in Alaska during the next year are to be taken up with increased activity, it emphasizes the necessity of establishing a field station by which the inspector in charge could cooperate with steamship lines to insure prompt reports of dangers discovered and other information affecting the coast charts.

The question of a location for such a station is, of course, governed by its accessibility to the shipping interests and its relations to the field of surveying operations. Situated as it is on the main artery of commerce, Ketchikan has been selected as the most suitable port for a field station of the Survey in southeast Alaska. By reason of the fact that the shore-surveying season opens earlier and closes later in this section than in others, Ketchikan is better suited for hauling out and storing the floating equipment. It is more accessible to the market from which supplies and repair material will be sent for the upkeep of the launches and wire-drag apparatus, and if arrangements can be made for storing coal for the surveying vessels the freight rate on such coal, supplies, etc., would be at a minimum cost.

By reason of its accessibility, other Government bureaus are represented at Ketchikan, notably the Bureau of Lighthouses and the Forest Service. With the Coast and Geodetic Survey represented by one of its commissioned officers at that place, close cooperation with the local representatives of these bureaus could be maintained, with resulting benefit to the maritime and commercial interests.

WHAT IS NEEDED TO BETTER ACCOMPLISH THE FIELD WORK.

For the past five years the Director of the Coast and Geodetic Survey has reiterated in his annual reports the urgent need of the Bureau

for better vessels to carry on its hydrographic surveys. Each year he has repeatedly pointed out the false economy of trying to accomplish surveys with the fleet of old vessels that are now the property of the Bureau. Some of these that have been in the service for years are now actually unseaworthy and can only be used under the most favorable conditions, yet the cost of operation of these old vessels in personnel, fuel, etc., is no less than would be the cost of operation of efficient vessels, yet the limitations on the purpose for which these old vessels may be used on account of their unseaworthiness are such that an enormous amount of time is lost and the cost per unit of accomplishment is excessive, but with no other means at his disposal for making the surveys called for he has no other alternative but to continue the work, excessive as the costs are.

Beginning in 1914 the Bureau has been endeavoring to replace its worn out and unseaworthy surveying vessels by adequate modern vessels and to build up the fleet sufficient to meet insistent demands for hydrographic surveys in the United States, Alaska, the Philippine Islands, and elsewhere in the insular possessions, but the necessary funds have not been provided. The total amount provided to date for the construction or purchase of new vessels during the last 16 years has been only $296,000. Meanwhile the demand for new surveys has become increasingly insistent, particularly in Alaska, although the demand for surveys of the waters of continental United States is urgent.

During the war nearly all the vessels of the Coast and Geodetic Survey were transferred to the Navy and were used for military purposes. For this reason and because most of the officers also were on military duty, very little surveying was performed by the Bureau during that time, and as a result there is a two years' accumulation of work which, together with the normal annual work, can not be accomplished with the present fleet. With the cessation of hostilities the Navy was in possession of a considerable fleet of auxiliary vessels which had served their purpose as war craft and were available for transfer whenever required elsewhere in the Government service. It was realized that very few, if any, of these vessels were suitable for surveying, but because no other vessels were available the Bureau accepted some of these, regarding them as makeshifts until more suitable vessels could be provided, but hoping that from the lot a few could be obtained that would serve the purpose of the Bureau in a measure for several years.

With this fleet, together with the former Coast Survey vessels which were returned by the Navy, the Bureau endeavored last summer to resume surveying operations. The first season's work with these ex-Navy vessels showed conclusively that, with one or two exceptions, they were absolutely unsuitable for the work, that the unit

cost of work performed with such vessels was abnormally high, and that much of the most urgently needed work could not be done at all with them. Of the seven vessels received from the Navy, two were turned back before any surveying work had been done, as the cost of putting them in operating condition would be out of proportion to their original cost or present value. One more vessel will be turned back this winter for the reason that her condition is such that the cost of putting her in seaworthy condition would not be justified by the amount of surveying work that could be accomplished with her annually. The other vessels will do fairly well for a few years, but will always be inefficient.

In the year 1914, the Coast and Geodetic Survey operated 16 surveying vessels, 4 of which were the property of the Philippine Government and the balance were owned by this Bureau. Five of these vessels were over 30 years old at that time and only 6 of them (3 United States vessels and 3 Philippine vessels) were under 15 years of age. Two of the vessels were built in 1859 and 1862, respectively. Prior to 1914 the Coast and Geodetic Survey had not acquired a new vessel since 1904.

In 1915 one of the oldest vessels was condemned as unseaworthy, and an appropriation of $289,000 was made for the purchase or construction of two surveying vessels. As this amount was too small to permit the construction of two new vessels, it was necessary to purchase the best possible vessel at the smallest cost, so as to leave sufficient funds for the construction of one vessel. The Bureau was particularly fortunate in securing a fair yacht at a cost of $60,000, and thus was able to enter into contract for the construction of a modern surveying vessel, which ultimately cost $236,000. As the surveying vessel was not completed until 1917, the net gain in the number of ships that year was naught.

In 1919, 7 vessels were obtained from the Navy, but during 1918 and 1919, 7 vessels were disposed of, so that there was no change in the number of the fleet over 1917. Of these 7 vessels, 2 were Navy vessels returned because they could not be used in survey work, 3 old vessels were condemned and sold (1 of them the vessel built in 1859), 1 vessel (the property of the Philippine Government) withdrawn from survey operations, and 1 vessel wrecked.

It will therefore be seen that at the present time the number of vessels available for use of this Bureau is one less than the number available in 1914. Furthermore, as stated above, a third naval vessel must be disposed of this year, as she is no longer fit for survey operations, thus reducing the fleet to two less than the fleet of 1914. This fleet is, of course, superior to the 1914 fleet, as the oldest vessels have been weeded out and replaced by newer craft; but on the whole

these ships, with the exception of the one new vessel constructed in 1915 and 1916 and one vessel obtained from the Navy, are not very much more efficient than were the old vessels. Furthermore, the Bureau has now 14 vessels to do a vastly greater amount of surveying than was required in 1914 from 16 vessels. If we assume that these 14 vessels can do as much work as the 16 vessels of the 1914 fleet, and it is not at all certain that they can do this, it is evident that there will be no advancement in surveying operations. We shall steadily drop behind in this work, each year the charts will become more out of date, and the public will have to be told that we can not assist in opening up new steamship routes as rapidly as commerce demands.

If this Bureau is to keep its charts up to date, to make revisional surveys where depths have changed, to provide the charts urgently needed for the navigation of our coastal waters, and to chart the at present uncharted portions of Alaska where industries have recently opened up, it will be necessary to provide as soon as possible three new surveying vessels of the most efficient type and exactly suited to this work. Two of these vessels should be of the *Surveyor* type (the vessel that was built for the Bureau in 1916–17) and the third should be a small light-draft vessel for use in bays, rivers, and sounds.

Hydrographic surveying can be efficiently and economically done only with appliances, including vessels, exactly suited to the work. It might be thought that any vessel of the proper size could be used fairly successfully in this work, and this might be true if the function of the surveying vessel is only to provide a means for transporting the hydrographic party. This, however, is not the case. An efficient surveying vessel is really an instrument, or, perhaps, might better be described as a floating stand on which certain surveying instruments can be mounted. In order that these instruments may be operated to their full capacity, it is necessary that the stand (surveying vessel) be as steady as possible; that it remain reasonably dry when the sea is rough; that it be provided with power for moving it quickly from place to place and for placing it exactly at any desired spot on the water; that it be rugged enough to withstand severe storms; and that it be large enough to carry all necessary surveying instruments, including small surveying launches, and at the same time be not unnecessarily large, thus requiring unnecessarily heavy machinery to operate. These are some of the requirements of a real surveying vessel; and in addition to the abovementioned requirements it should have suitable quarters for accommodating the surveying parties and sufficient fuel capacity for enabling it to remain away from the base of supplies for a considerable period. These qualities can not be found in any vessel designed

for purposes other than surveying. Consequently it is impracticable to secure suitable surveying vessels except by building them.

A comparison of the cost of work accomplished with an efficient surveying vessel with similar work performed with vessels not designed for this purpose brings out interesting facts. The Bureau is now operating several yachts that were acquired by transfer from the Navy at the termination of hostilities. These are very good yachts; they compare well with vessels of their type and probably satisfy the requirements for a survey vessel as well as does any type of vessel not designed for surveying. During the past season two of these yachts and one of our specially designed surveying vessels were employed in the same general locality, on similar work, under similar conditions, and therefore the cost of operating these three vessels at that time is fairly comparable. The larger of the yachts cost $10,840 per month for all expenses, the smaller of the yachts cost $8,414, and the surveying vessel cost $16,372. It would therefore appear that the smaller yacht was the most economical, but the smaller yacht could carry officers, men, and equipment, including boats, for the operation of only two parties. The larger yacht, for the same reason, could accommodate only three parties, whereas the surveying vessel, having been designed to meet the requirements stated above, permitted the operation of five surveying parties. It is therefore evident that the cost of surveying with the surveying vessel was $3,274 per party per month; for the larger yacht, $3,613 per party per month; for the smaller yacht, $4,207 per party per month. In other words, the larger yacht cost 10 per cent more than did the surveying vessel for the same amount of work, and the smaller yacht cost 28 per cent more for the same amount of work.

NEED FOR WIRE-DRAG LAUNCHES.

Much has been said in the past of wire-drag launches in discussing the needs for equipment of the Coast and Geodetic Survey. The advisability of having Government-owned launches has been pointed out and appropriations have been asked for to supply this needed equipment.

Not until the summer of 1919 was it possible to draw an actual comparison of the value of these launches with those which heretofore have been obtained from private sources at large rental cost and expense in altering them for the wire-drag work.

During the summer of 1919 for the first time the Survey had in operation four specially constructed wire-drag launches working on the New England coast, which demonstrated their efficiency in carrying on wire-drag surveys. The launches are specially designed

for this class of work, and therefore have the proper amount of space for the appliances required in the search for submerged dangers. They have been found far superior to the clumsy vessels that have been hired heretofore for towing the wire drag and on which the Bureau has been forced to spend time and money in making alterations to fit them in a measure for the work.

With this efficiency and economy evidenced by their use during the summer of 1919, it is apparent that the addition of at least four new launches to the four already provided is warranted.

The new specially designed launches permitted installation of permanent equipment. The power reels heretofore used on the chartered launches were an outgrowth from a crude hand apparatus unduly cumbersome, complicated, and unsightly. They were designed as temporary expedients, to be put on and hauled off the launches every few months, with the natural result that they include features that could be greatly improved in a permanent installation. Such permanent design has been made, the underlying idea being to secure simplicity, compactness, reliability, and permanency.

PHOTOGRAPHIC SURVEYING.

On July 1, 1919, the Bureau had an officer at Atlantic City, N. J., establishing control for airplane photographs which were subsequently made by the air services of the Army and of the Navy for the purpose of determining experimentally how accurately the country could be mapped from such photographs. A mosaic of Atlantic City constructed from these photographs, together with the individual photographs, was studied with reference to the control. At the same time the party on the Survey steamer *Hydrographer* was experimenting near Key West, Fla., with airplane photographs of water areas to determine to what extent, if any, submerged objects and the nature of the bottom could be detected on such photographs. These photographs were taken by the Navy Air Service officers stationed at Key West.

The results obtained from the Atlantic City experiments, while inconclusive and on the whole rather unsatisfactory, still indicate that airplane photography may be of great assistance in mapping the land. The results of the Key West work indicate that with present photographic equipment no dependable information can be had of underwater conditions. Because of the very important part that airplane photography will certainly take in land surveying if some of the obvious difficulties can be overcome, it has been considered worth while to devote as much study to this subject as practicable. One officer has been detailed to devote his entire time to the subject

and has been given the best facilities for investigation that the Bureau can supply. He has been in close communication with those who are working on this and allied subjects at Washington and elsewhere. He represented this Bureau at a series of experiments conducted last spring at Dayton, Ohio, by the Air Service of the Army. It is believed that substantial progress has been made during the year, although the disorganized condition of the air services, as the result of the demobilization of the Army and the Navy, has necessarily retarded experimentation.

BUREAU OF NAVIGATION.

American shipping registered for the foreign trade and enrolled and licensed for the coasting trade, including the fisheries, on June 30, 1920, comprised 28,183 vessels of 16,324,024 gross tons, compared with 27,513 vessels of 12,907,300 gross tons on June 30, 1919, an increase of 670 vessels and 3,416,724 gross tons. The following statement shows the total of our tonnage at the close of each of the past seven fiscal years and indicates the great changes which have taken place since the outbreak of the World War.

June 30—	Foreign trade.	Coasting trade.		Total.
		Great Lakes.	Sea and rivers.	
1914	1,076,152	2,882,922	3,969,614	7,928,688
1915	1,871,543	2,818,000	3,699,886	8,389,429
1916	2,191,715	2,760,815	3,517,119	8,469,649
1917	2,446,389	2,769,824	3,654,814	8,871,037
1918	3,603,706	2,708,523	3,612,289	9,924,518
1919	6,669,726	2,635,680	3,601,894	12,907,300
1920	9,928,595	2,595,062	3,800,367	16,324,024

In the coasting or domestic trade both of the Great Lakes and of the seaboard and rivers there has been an actual decrease since 1914, a situation wholly abnormal and due to the fact that tonnage, withdrawn for war purposes from those trades, has not yet been fully returned, and very little new tonnage has yet been built to supply those trades. Virtually none of the tonnage built during the war on the Great Lakes or taken to the seaboard is now adapted to the special trades of those waters, but much of the war tonnage must find employment in the seaboard coasting trade or be tied up.

The growth of American shipping has been wholly in the foreign trade, much more than half of that growth having taken place since the armistice of November 11, 1918, and the increase during the past fiscal year being double that of any year before the armistice.

The returns of American tonnage just stated are, so to speak, an inventory of our shipping on June 30 of each of the years mentioned, stated in gross tons of 100 cubic feet each of the closed-in spaces of

the ships, including the engines, coal bunkers, forecastles, and other nonearning portions of the ship, as well as holds for freight-earning cargo and structures for passenger accommodations whence revenue is derived. This increase in tonnage would mean little unless it stood also for an increase in trade. The returns showing the actual employment of American ships in foreign trade are as gratifying as the returns showing the increase in our shipping assets.

The readiest and most intelligible evidence of the employment of our shipping is afforded by the returns of clearances. These returns are properly stated in net tons of 100 cubic feet of closed-in ship space available for carrying cargo or passengers, the spaces accordingly producing revenue, and excluding the spaces for engines, coal bunkers, and crew quarters which involve outgo and not income. If a ship clears several times in the year for a foreign port, of course its net tonnage will be repeated in the total, while in the statement in gross tons of our assets, each ship is included only once.

The net tonnage of clearances of American ships during the fiscal years ended June 30, 1914 and 1920, to the several continents and archipelagoes overseas, and separately to the Provinces of Ontario and Quebec and to the rest of North America are stated below, the geographical division being desirable, because the length of voyages is obviously a factor in the employment of shipping.

To—	1914	1920
	Net tons.	*Net tons.*
Europe	447,667	7,521,665
South America	192,479	1,879,918
Asia and Oceania	100,833	1,404,024
Africa	4,263	226,685
Total overseas	745,242	11,032,292
North America, except Ontario and Quebec	9,580,133	12,614,663
Ontario and Quebec	3,414,443	5,350,594
Fisheries	810	.....
Grand total	13,740,628	28,997,549

In a word, while our gross tonnage registered for foreign trade is tenfold what it was in 1914, it has supplied in actual employment in overseas trade fourteen times the American cargo and passenger space available in 1914, though in the shorter voyages to foreign ports in North America, requiring fewer and usually smaller ships, the increase—and the demand—have not been so great.

The increase in both American tonnage and in American clearances for foreign ports is the more significant when compared with the gross tonnage of the rest of the world. The best returns on this

subject are furnished by Lloyd's Register of British and Foreign Shipping, which gives the following totals of gross tonnage under the flags of maritime nations and of the rest of the world in June, 1920, compared with June, 1914, as follows:

	1920	1914		1920	1914
	Gross tons.	*Gross tons.*		*Gross tons.*	*Gross tons.*
British	20,582,652	21,045,049	Swedish	1,072,925	1,118,086
American	16,049,289	5,368,194	Flag not recorded	1,305,827	.....
French	3,245,194	2,319,438	German	672,671	5,459,296
Japanese	2,995,878	1,708,386	All others	5,134,452	6,401,600
Italian	2,242,393	1,668,296	Total	57,314,065	49,089,522
Norwegian	2,219,388	2,504,722			
Dutch	1,793,396	1,496,455			

The rest of the world, outside of the United States, has not yet made wholly good the losses inflicted by ruthless submarine warfare, although the redistribution of tonnage consequent upon the war and the accelerated production have effected several notable changes in the relative maritime rank of nations since 1914. In the table above, the tonnage classed as "Flag not recorded" is mainly that part of German and Austrian shipping not yet distributed among the victorious powers.

Excluding American ships, the world's gross tonnage, as stated, has not yet recovered fully from the war's losses, and industrial and commercial conditions in most European countries are far from normal. These familiar facts have two obvious bearings on the trade by sea between the United States and foreign nations, maintaining and even increasing the volume of our export trade, while reducing the foreign tonnage engaged in it. The net tonnage of clearances of American ships in the foreign trade of the United States for the fiscal years 1914 and 1920 has just been stated, and the following gives the corresponding clearances of foreign ships from the United States for the same years:

	1914	1920
	Net tons.	*Net tons.*
Europe	19,598,524	13,430,123
South America	2,237,181	1,510,220
Asia and Oceania	1,889,272	2,094,984
Africa	402,194	485,102
Total overseas	24,127,171	17,520,429
North America, except Ontario and Quebec	5,170,796	4,277,633
Ontario and Quebec	10,141,741	5,276,770
Fisheries	3,083	.....
Grand total	39,442,791	27,074,832

Such are the main facts about American and foreign shipping in the foreign trade of the United States during the fiscal years 1914 and 1920, stated in the briefest form for comparison. The value of the exports and imports carried is some measure, with proper qualifications, of the value of the carrying trade itself. Following, accordingly, is a comparative statement of such values of cargoes carried in American and foreign ships for the two fiscal years named:

	American ships.	Foreign ships.	Total.
1914.			
Exports	$169,436,090	$1,878,323,769	$2,047,759,859
Imports	198,923,666	1,538,784,987	1,737,708,653
Total	368,359,756	3,417,108,756	3,785,468,512
1920.			
Exports	3,235,879,023	3,932,588,373	7,168,467,396
Imports	1,836,026,959	2,870,930,209	4,706,957,168
Total	5,071,905,982	6,803,518,582	11,875,424,564

The value of the cargoes carried in American ships during the past fiscal year was nearly 14 times greater than in 1914, exceeding relatively the increase in gross tonnage and equaling the increase in American clearances. The values of cargoes carried in foreign ships was double the value in 1914, although the gross tonnage under foreign flags is less than in 1914 and the net tonnage of foreign ships cleared from the United States was much less than in 1914.

The general facts illustrating maritime changes during the past six years have been set forth both to show the gratifying progress of American shipping under the stimulus of war and the forces it evoked and also to indicate the general maritime situation at the present time and our relations to it.

During the three years from July 1, 1917, to July 1, 1920, Congress voted and the Shipping Board has expended, in round numbers, $3,000,000,000 on building ships, including the establishment or extension of shipyards and for other purposes contributory to shipbuilding. As a result, the American Government owns, in round numbers, 8,000,000 gross tons of seagoing shipping. It is by virtually this amount that the world's tonnage is now greater than it was in 1914 and the expenditure, as stated by my predecessor, is greater than the book value of all the merchant fleets of the world at the outbreak of the war. Congress at its last session decided to stop further appropriations for shipbuilding, thus terminating, so far as the United States is concerned, the operation of one of the principal, if not the principal, causes which have worked the great changes that have been briefly noted. The effects of that cause, however,

will abide for some years to come in the redemption of the debt incurred and in the use and disposition of the property acquired afloat and ashore. The interest on the debt may be computed fairly at the present time at the annual rate of 5 per cent and the sinking fund requirements involve 2½ per cent more, or an annual charge of 7½ per cent on $3,000,000,000, which is $225,000,000. The sinking fund requirements will not, of course, fully provide against the depreciation of the ships and plants ashore, especially in view of the unusual conditions of their construction and establishment; so prudence suggests a write off of 5 per cent on this account, or $150,000,000; in all, an annual charge of $375,000,000. This charge, of course, is subject to reduction by the amount of the excess of the earnings of the ships over the cost of operating them, so far as applied to that purpose, and is subject to further reduction as the proceeds of the sale of capital assets, ships, and plant ashore may be applied further to the retirement of bonds through sinking-fund operations.

These considerations must not be lost sight of, because the first cost of ships is once again a fundamental matter to be considered in questions of foreign and domestic commerce by sea as well as in the more restricted area of questions relating solely to shipping. It has been the real basis for many years of most controversies here and abroad over the restrictions of the coasting trade, free ships, subsidies, discriminating duties, and other questions of maritime policy. During the war the question of cost in all directions was subordinated to the sole consideration of winning the victory, but it has already reasserted itself and must receive attention. Our experiences with the railroads should be a sufficient warning of the commercial and financial dangers of inflated first costs. With or without reason—it is not intended to discuss that here—the country some years ago formed the impression that railroad freight rates and passenger fares were excessive, due to inflated first costs, represented by the issue of securities, and in the effort to meet the situation it will be recalled our railroad systems were brought into difficulties from which they have not yet wholly emerged. We should meet the analogous shipping situation promptly. There can be no question whatever that our war-built shipping actually, and in most cases unavoidably, cost very much more than any other shipping afloat, and it can not meet the customary annual charges on such first cost, to which I have referred, and compete in normal times with ships paying normal fixed charges on normal first costs.

We must be candid with ourselves; and the value of the ships owned by the Government must be reduced to their actual value for competitive purposes at the present time, and the difference between that

value and the first cost should be charged to the cost of winning the war. The interest on that difference, the corresponding contribution to the sinking fund, and the corresponding allowance for depreciation will be treated thus as war losses, and this surely is preferable to a continued failure to make annual payments on account of the merchant marine to interest, sinking fund, and depreciation. The people of this country are fully aware that the war involved great costs and losses and, in my judgment, would prefer to acknowledge such losses, write them off, and start in fresh, rather than for years to come carry these losses in their merchant-marine account in the form of interest, sinking-fund contribution, and depreciation unpaid by their shipping, but met by taxation.

To repeat, these matters are presented because they not only go to the core of the shipping question, but because they affect the exports and imports which the ships carry. If impossible first costs are maintained, then abnormal annual charges based on those costs must be paid for years to come either through taxation for the purpose, or to the extent possible, which will not be adequate, through excessive transportation rates, in themselves a burden on commerce. The real value, the usefulness of our merchant shipping, is not affected, for that depends on the physical and financial adaptability of the ships to the trades in which they are employed and on the intelligence, prudence, energy, and foresight with which they are managed and navigated.

GOVERNMENT OWNERSHIP.

The striking feature of the changes during the fiscal year has been the steady and rapid growth in the Government's ownership of our seagoing shipping. Nearly all our foreign trade and the greater part of our coastwise trade by sea are carried on by ships of 1,000 gross tons or over, and the vast expenditures by Congress for the building and operating of ships to win the war were almost wholly applied to ships of that tonnage. This tonnage limit is somewhat arbitrary, and the Government's ships are nearly all over 2,000 gross tons, while in some lines of trade with near-by countries and in the coasting trade some ships under 1,000 gross tons are employed by private enterprise.

The recent growth of the Government's ownership of these ships of 1,000 gross tons is shown by the following statement of the number and tonnage of such ships registered or enrolled in the name of the United States, represented by the Shipping Board and of those of commercial companies and individuals on January 1, 1919 (soon after the armistice of November, 1918), on July 1, 1919, the begin-

ning, and July 1, 1920, the close of the fiscal year just ended, and on October 1, 1920:

	Shipping Board.		Private shipowners.		Total.	
	Number.	Gross tons.	Number.	Gross tons.	Number.	Gross tons.
Jan. 1, 1919	608	2,305,015	1,055	3,351,841	1,663	5,656,856
July 1, 1919	982	3,827,203	1,076	3,472,819	2,058	7,300,022
July 1, 1920	1,630	6,903,128	1,209	3,942,974	2,839	10,846,102
Oct. 1, 1920	1,698	7,288,208	1,266	4,194,709	2,964	11,482,917

The Government's plant afloat is over three times its size at the time of the armistice, and the increase during the fiscal year has been over 3,000,000 gross tons. These facts, however, are not the evidence of a tendency in American sentiment toward a policy of Government ownership and operation as related to maritime affairs, but are merely the result of appropriations by Congress to meet exigencies created by the World War. Such appropriations ceased with the end of the past fiscal year, and during the current fiscal year the Government plant afloat must begin to decrease, as it will depend for existence on the sale of capital assets in ships and plants ashore and on the proceeds of operations, including or excluding interest, depreciation, and other capital charges, as the accounts may be stated.

SHIPBUILDING.

In the three years following July 1, 1917, the Government of the United States, through the Shipping Board, has expended, in round numbers, $3,000,000,000 in building merchant ships, creating or extending shipyards for the purpose, providing houses and local railroads, and in other directions establishing a shipbuilding industry adequate to produce 400,000 gross tons of shipping a month, the output our allies asked us to attain when we entered the war and the amount necessary to make good losses at the rate at which they were incurred during the spring and early summer months of 1917. The peak of monthly production was attained the second month of the past fiscal year, August, 1919, when the vessels built in the United States, which were officially numbered (a date following the launch, but usually before the issue, of the register), aggregated 238 of 455,338 gross tons, of which 85, of 397,733 gross tons, were seagoing steel steamers. The peak of annual output was attained a month later, and from September, 1919, up to March, 1920, we were building ships at the annual rate of 4,250,000 gross tons, of which 3,600,000 gross tons were seagoing steel steamers, the output of which reached its maximum for a year, 831 steamers, of 3,679,285

gross tons, during the 12 months ended March 31, 1920. This last-named tonnage was larger than the world's output of ships in 1913, the year of greatest prewar production, 3,332,882 gross tons.

The vast expenditure of public money which produced these results was among the sacrifices made to win the war, and we have more to show for that sacrifice even than the great tonnage of ships still in the possession of the Government. In indirect effect, though not in purpose, the expenditures were the greatest pecuniary support to shipping and shipbuilding ever contemplated by any maritime power, probably greater than the sum of all the appropriations from public funds by all maritime nations combined for merchant shipping ever made since the days of steamships. From such an effort we are justified in looking for permanent benefits in the establishment of the shipbuilding industry on a basis that will enable it to compete on terms of equality with the industry elsewhere. A glance at our exports will show that the main materials for shipbuilding—steel and iron in their many forms, copper, brass, wood—we produce more abundantly and at less cost than other nations. In the creation of new shipyards and the extension of older ones plans were followed from the outset to effect the maximum of output in the minimum of time, and to the development of these plans the highest technical skill, spurred by a necessity never felt before, applied itself. The machinery of the yards represents, in the main, the best that a naturally inventive nation could devise at a time when our highest scientific minds centered their efforts on the mechanical problems of war, of which, to us, shipbuilding was one of the greatest. During three years it is probably within bounds to state that over 1,000,000 men new to the industry were trained in the manual processes of shipbuilding. The turnover of labor in the industry has doubtless been very great, but the fact that within three years the maximum annual output of American shipyards increased from 600,000 gross tons before the war to 4,250,000 gross tons after the war is conclusive as to the development which the plants and machinery and the labor attained under the stimulus of war and the appropriations by Congress. The fact that in August, 1920, American shipyards were building or under contract to build for private shipowners 389 steel vessels of 1,335,000 gross tons, excluding those building at public expense for the Shipping Board, is further evidence of the substantial basis on which American shipbuilding now rests.

ADMINISTRATIVE NEEDS.

The possession of a vast tonnage afloat is gratifying to national pride, but it must not lead us to overlook the responsibilities which that possession imposes, particularly in view of the fact that most

of this tonnage is employed in foreign trade and must conform therefore in the main to the reasonable requirements of custom and practice as determined by the experience of maritime nations.

The Department of Commerce, which was established as the maritime branch of Government and has within its jurisdiction the merchant shipping of the United States, as well as, so far as the navigation laws are applicable to it, the vast Government fleet owned by the United States Shipping Board, is inadequately equipped for the performance of the duties imposed upon it. The need of rigid economy at this time in all branches of Federal expenditure is fully recognized, but at the same time the expenditure of three billions of dollars within three years on shipbuilding and the entry into foreign trade of the tonnage built require additions to administrative machinery. The subject was presented in the report of my predecessor last year, and his observations are confirmed by the year's experience. The Department of Commerce should have a small technical staff, two or three competent men would suffice, who could deal with questions of the structural details of passenger ships as they arise from time to time. It should have another small technical staff to deal with the administration of details of load-line legislation for cargo boats.

Since the armistice of November, 1918, and especially during the past fiscal year, the Department of Commerce has been compelled to take a part in the discussion of technical questions of construction inseparable from the possession of a merchant fleet in foreign trade. Though three billions of dollars have been spent on the fleet, and a modest amount, between $50,000 and $75,000, would suffice for the purpose indicated, the Department of Commerce has been compelled to state frankly to those concerned about the reputation of the fleet, as well as its size and the money spent on it, that no money was available for necessary study or preparation for consultation, and it had to appeal to the Navy Department, the Society of Naval Architects and Marine Engineers, the American Bureau of Shipping, and to professors of naval architecture in principal colleges and universities, shipbuilders, and shipowners to undertake the studies and preparations and supply results on which an intelligent opinion could be formed by the Department. The situation was accepted as an outgrowth of the war and the response to the Department's appeal was prompt and generous. The work referred to is necessary to the maintenance of merchant shipping, and appropriations should be made for it.

The subject of the admeasurement of vessels is associated indirectly with subdivision of hulls of passenger ships and load lines of cargo steamers. Admeasurement is the determination of the cubical contents of a ship, and it is palpably a somewhat intricate and technical

process. With 28,000 documented vessels aggregating over 16,000,000 gross tons the provision hitherto made for the adjustment of matters relating to measurement and the general supervision of the work comprises an adjuster at $2,260, an assistant at $1,600, and $1,500 for instruments, travel expenses over the United States, and incidentals; in all, $5,360. The actual work of measurement is performed by clerks assigned for the purpose in the customhouses. In some instances there are competent men, trained to the work, upon whose results reliance may be placed; in others, men are detailed from time to time from desks of tariff computations and merchandise appraisal and do the best they can at an unfamiliar job.

Our fleet in foreign trade is mainly an improvisation of the war and consists of relatively few types of ships, reducing and simplifying admeasurement problems. Accurate admeasurement is a factor in maritime competition among nations, and more money should be voted to get that result in this country. A detailed plan to cover the subject was prepared in the Bureau of Navigation three years ago, and will be submitted.

HULLS AND LOAD LINE.

The recommendations of the International Conference on Safety of Life at Sea in so far as they relate to the subdivision of hulls and other structural details of passenger ships have had further consideration, and further progress has been made in preparations to give them effect as modified by the experience of submarine warfare. My predecessor last year invited the American delegates who gave this subject particular attention at the International Conference (Rear Admiral W. L. Capps, United States Navy; Homer L. Ferguson, president of the Newport News Shipbuilding & Dry Dock Co.; Alfred Gilbert Smith, president of the New York & Cuba Mail Steamship Co.; and Capt. Lewis B. McBride, United States Navy) to go over the subject in the light of the developments of the war bearing upon hull construction. These gentlemen met with several eminent British Government officers, naval architects, and shipowners, who came to Washington in May for the purpose, and after full discussion they agreed substantially on several changes which will tend both to increase the safety of the ships and at the same time render holds more suitable for the kinds of cargo frequently carried on passenger ships. Further informal conversations will be desirable during the current year. The chapter on construction was one of the most valuable in the International Conference on Safety of Life at Sea, ratified with reservations by the Senate on December 16, 1914. The outbreak of war delayed action on the convention, but on July 4, 1920, it was ratified by the French Government, and other

ratifications are now probable. It had already been ratified by the Governments of Great Britain, Spain, and Sweden.

In view of our great fleet of cargo boats, the failure for two years to enact a load-line law is incompatible with our aspirations to be considered a maritime nation. The load-line bill was passed unanimously by the House of Representatives in October, 1919, and was favorably reported the same month to the Senate, but was recommitted and still awaits action by the Senate Commerce Committee. The reasons for the bill have been stated so often that repetition here is unnecessary. The passage of the bill at the coming session of Congress is earnestly recommended.

INTERNATIONAL AGREEMENT ON RADIO COMMUNICATION.

In this report last year it was stated that the developments in radio communication and the great improvement in transoceanic radio communication point to the need of a revision of the International Radiotelegraphic Convention of 1912. The State Department has deemed it advisable to include the revision of this convention within the deliberations of the preliminary international conference on communications between representatives of the United States, France, Great Britain, Italy, and Japan to be held in Washington in October, 1920, and of the international conference on communications, at which nations generally will be represented, to be held a few months later. To insure that the views of the United States on the revision of the Radiotelegraph Convention should be formulated intelligently, and after full consultation with the many interests concerned, I invited on February 26 the representatives of such interests, inventors, scientists, managers of operating and manufacturing companies, and amateurs to meet at the Department of Commerce on March 30 to consider the subject with representatives of the Treasury, War, Navy, Post Office, and Commerce Departments, and the Shipping Board. The basis for discussion was the report of the military and naval commission at Paris which drafted proposed amendments to the convention of 1912. The meeting selected and I appointed a committee representative of all the interests concerned to consider the report just mentioned. This committee gave long and painstaking consideration to the report, and on May 13 its unanimous report, suggesting various changes in the military and naval report, was agreed to by all, and has been referred to the American delegates to the Conference on Communications, with the approval of the War, Navy, and Commerce Departments.

The act of August 13, 1912, to regulate radio communication was based on the international convention and requires amendment for

the same reasons that the convention of 1912 should be amended. The revision of the act of 1912 can not well be undertaken until the Conference on Communications has concluded its deliberations, probably late this year or early in 1921. If those deliberations shall result, as anticipated, in a revised international radiotelegraphic convention, a bill in accord with the convention will be prepared and the ratification of the convention and the passage of the act may be considered by Congress at the same time.

RADIO COMMUNICATION.

The increase in the physical volume of the work of the Radio-Inspection Service during the year has been so considerable that the Service would have been inadequate to the work if Congress had not provided by deficiency appropriations for an increase in the staff from 25, the number before the war, to 45. Even with this increase it has been necessary to select the most pressing work out of what there was to be done and to perform or omit less pressing work as time and opportunity permitted. The inspection of ships' apparatus before the departure of the ship is evidently the most important work from the point of view of safety, and such inspections during the year numbered 5,419 at 18 ports, compared with 5,160 for the previous year. This branch of operations has been satisfactorily covered. Next in importance has been the maintenance of an adequate number of skilled operators to meet the great increase in the number of ships equipped with radio apparatus. The number of applicants for commercial operator's license examined was 7,932, of whom 4,652 passed the examinations and were licensed, compared with 1,645 out of 2,498 during the previous year. The high standard of American commercial operators has been maintained and is generally recognized by other maritime nations. The work of examining ships' apparatus to determine full compliance with international regulations is still very much in arrears. On June 30, 1920, 1,158 licenses under the international rules had been issued, although 2,808 American ships were equipped with wireless apparatus, while on June 30, 1919, 976 licenses had been issued, and 2,312 American ships were equipped. The examination of apparatus for compliance with international rules is often a slow, technical process, requiring at times half a day, and the tests must be made without interfering with commercial radio communication. The number of new ships will not increase as rapidly during the current year as during the past fiscal year, and it should be possible to bring this branch of work up to date.

Under the joint resolution of Congress of June 5, 1920, commercial coast stations were authorized to resume communications with ships

at sea. Preparations in advance had been made for the shift from war conditions to peace conditions by the concurrent action of the Navy Department and the Department of Commerce, and 157 licenses, after examination of apparatus, were issued to commercial and experimental coast stations. The transfer was effected at New York before the close of the fiscal year and is in progress at other points along the coast. Special examinations were made of the apparatus of high-powered commercial stations for transoceanic communication, and before the close of the fiscal year such communication was established satisfactorily with Norway and with Great Britain, the Navy Department withdrawing from these areas of operations. War regulations against the operation of amateur stations and the license of amateur operators were withdrawn early in the year, and, as anticipated, there has been a great development in this line of radio activity. In 1917, before we entered the war, 3,741 amateur stations were licensed; during the past fiscal year 5,729 amateur stations were licensed; in 1917 there were 3,302 licensed amateur operators, many of whom rendered good service with our troops on European battlefields, some whole wireless companies of the Signal Corps being composed almost exclusively of licensed amateurs. During the past year 5,988 amateur operators were licensed. From many points of view, the development of amateur interest in radio communication should be encouraged in the interest of the Nation, for radio communication is certain to render increasing service in the country's system of commercial communication, and in communication between the air and the land, as well as the sea and the land; between ship and ship, airplane and airplane, it is the only means of communication for considerable distances. The Bureau of Navigation hopes to be able to give to amateur apparatus and operators such attention as the staff and means available will permit.

No special foresight is required to predict that before long Congress should make more adequate provision for the regulation of radio communication than has hitherto been made, and it is equally clear that such provision must be made within the limits of rigid economy, imposed by our heavy war taxes and great war debt. The first reason for Federal inspection and regulation of radio communication both in time and importance is its part thus far in securing safety of life and property at sea, which is now being extended to the air, and doubtless in time will extend more generally to the railroads. So much depends on the skill of the operator and the reliability of the apparatus that examination, inspection, and certification may properly be prescribed by Federal authority. The second reason for regulation is that in its present stage of development radio communication, to avoid interference with itself and consequent confusion and uselessness, must follow certain regulations

which, in view of the wide radius of action, can be prescribed in this country only by Federal authority. This interference is the basis of most regulations, national and international, of radio communication. Some progress has been made in lessening interference, and with the higher scientific development of the art it may in time be wholly removed and with its removal will disappear the main reason for regulation. This possibility, however, does not alter the present need of regulation. During the war the interest of the Army and Navy in radio communication, as in most other things, was paramount, but for the future radio communication, like the telegraph, must be mainly the servant of commerce, although our armed ships and forces, our military and naval airplanes and seaplanes are directly concerned in its operations. It seems to me, therefore, that the administrative responsibility for the regulation of radio communication should rest, as it has done since Congress first acted in 1910, with the Secretary of Commerce, and that as other interests than commercial are involved they should be consulted and harmonized through the deliberations of informal meetings of those concerned, as was done with measurable success up to our entry into the war. The creation by statute of a commission on radio communication involves not only heavy increase in the overhead cost of administration, when in fact the real need is for a larger and more highly trained field inspection force, but also all the delays and uncertainties inseparable from a commission as an administrative agency as distinguished from a judicial and deliberative body.

SHIPPING COMMISSIONERS.

During the year 628,980 officers and men have been shipped and discharged, including repeated shipments and discharges, by shipping commissioners, compared with 485,796 for 1919 and 378,772 for 1914. Collectors of customs, acting as shipping commissioners at ports where those officers are not established, shipped and discharged during the year 63,426 men, compared with 39,978 during the previous fiscal year. There were 14 shipping commissioners' offices at the beginning of the fiscal year. The deficiency appropriation act provided a shipping commissioner at Galveston, and that office was opened in May. Congress has provided for a shipping commissioner this year at Charleston, S. C., where 3,659 men were shipped and discharged by the collector of customs during the past year. The Department's estimates propose for next year shipping commissioners at Mobile, Ala., where 12,340 men were shipped and discharged last year; Savannah, Ga., where 5,690 were shipped and discharged; Portland, Oreg., where 4,688 were shipped and discharged; and Jacksonville, Fla., where 2,467 were shipped and discharged.

The shipping commissioners' service has been administered not only economically, but almost parsimoniously. During the past year the shipments and discharges numbered 628,980, as stated, and the salaries of commissioners and deputies were $85,949.50, making the average cost per man 13 cents. In 1894 the number of men shipped and discharged was 106,304, the expenses were $59,934.72, and the average cost 56 cents; in 1904 the number of men was 201,273, and the average cost 31 cents; in 1914 the number of men was 378,772 and the average cost 17 cents. The work of the shipping commissioners has not only increased in quantity, but in nature and scope, and it has become more difficult with the increased employment of our ships in foreign trade.

The questions to be decided are more difficult and numerous and the shipment of crews for cargo boats is harder relatively than for passenger liners with relatively large crews and regular sailings. The service actually needs more consideration by Congress if we are to maintain a creditable merchant marine. To repeat, a vast tonnage built at public expense is not a merchant marine, though it may be converted in whole or in part into a merchant marine. To that end the Government services indispensable to a merchant marine according to the laws and customs of maritime nations must be adequately provided for. A better system of seamen's records is needed both for seamen themselves and for public purposes, but it is quite impossible to provide these when appropriations do not suffice to enable commissioners to resume the work of shipping and discharging crews in the coasting trade, as before the war.

Of 334,140 officers and men shipped during the year, 137,016 were native-born Americans and 31,777 were naturalized Americans—in all, just over 50 per cent of the total. The increased American percentage for the past two years is mainly due to the appropriation of several millions of dollars by Congress to the recruiting service of the Shipping Board. For 10 years before the outbreak of the European war the proportion of Americans shipped annually ranged from 47 to 49 per cent, and from 1915 to 1918 it dropped to an average of 43 per cent.

NAVIGATION RECEIPTS.

The receipts from tonnage duties during the fiscal year amounted to $1,707,934.44 (including $935.10 Philippine Islands fund and $12,419.90 alien and penal tonnage duties and light money), compared with $1,265,229.23 for the fiscal year 1919. The increase was almost wholly paid by Shipping Board ships built with public funds, and is thus essentially a matter of governmental bookkeeping rather than an addition to revenue.

Receipts from navigation fees amounted to $176,087.39, compared with $143,492.19, the increase being due mainly to fees for the change of names of vessels imposed by the act of February 19, 1920, from which the revenue will be larger during the current year. The receipts from navigation fines and penalties amounted to $114,265.96, compared with $162,146.50 for the previous year, when a payment of $125,000 was made on account of the forfeited S. S. *Sacramento*. This year $70,000 was paid on the same account, and the remaining $55,000 should be paid during the current fiscal year.

The total navigation receipts for the year thus have been $1,998,287.79, compared with $1,570,867.92 for the fiscal year 1919 and $1,351,492.66 for the fiscal year 1918. The increase in this total during the three years has been due, as indicated, to special causes. It may be noted that the appropriation by Congress for all branches of the Navigation Bureau amounted to $287,070.35.

ENFORCEMENT OF THE NAVIGATION LAWS.

During the fiscal year 1920 the various services of the Bureau of Navigation reported 10,667 violations of the navigation laws. The number of violations reported exceeds by more than one-third the number acted on by this Department in any one year since its creation. There was an increase of nearly 100 per cent in the number of violations of the steamboat-inspection laws, principally through failures to have the required number of licensed officers or able seamen. There were 514 vessels reported for failure to have the required number of able seamen under section 13 of the seamen's act of March 4, 1915, an increase of about 40 per cent over 1919. The known violations of the motor-boat laws increased slightly over the previous year, due, to some extent, to the increase in facilities for enforcement of the law.

Collectors of customs, navigation inspectors, Steamboat-Inspection Service, and the Department's inspection boats constitute the principal agencies through which these laws are enforced. In addition to this, the Department has had the cooperation of the United States power squadrons in the education of motor-boat owners to the benefits of the laws relating to navigation and the safeguarding of lives and property.

In the consideration of violations of navigation laws presented to this Department for mitigation or remission of the penalties incurred, the inadequacy and difficulty of enforcement of penalties of various laws have become obvious, and the Department prepared and there is now before Congress a bill (H. R. 12102) which is intended to remedy these defects. I consider that the enactment of this bill into law is important in the administration of the laws hav-

ing to do with safety of life and property and the collection of the revenue.

During 1920 passengers were counted on 11,550 trips of excursion steamers, the number of passengers aggregating 4,758,473. Of these numbers the navigation inspectors made 9,893 counts of passengers aggregating 3,342,675. On 576 occasions it was found necessary to stop passengers going on excursion boats, the capacity of the boat having been reached. This involved the safety of 415,902 passengers.

During the past fiscal year steerage passenger ships on 664 voyages brought 296,066 steerage passengers to the United States, compared with 314 voyages carrying 55,603 passengers in the fiscal year 1919, 442 voyages carrying 67,988 passengers in the fiscal year 1918, 630 voyages carrying 147,493 passengers in the fiscal year 1917, and 720 voyages carrying 154,057 passengers in 1916.

MOTOR BOATS.

The inspection services of the Department continue to report improved conditions in motor-boat navigation. Up to July 1 last, 121,457 motor boats had been numbered under the act of June 7, 1918, an increase of 29,541 during the year. During recent inspection trips along the New England coast and through the Great Lakes from Buffalo to Chicago, a general compliance with the law was evident.

The Department now has five inspection vessels in service, employed principally in the enforcement of the motor-boat laws, although they do considerable work in preventing the overcrowding of passenger vessels, in enforcing the rules of the road, and in the supervision of the oyster and fishing fleets.

The inspection forces of the Bureau of Navigation continue to cooperate with the Bureau of Internal Revenue in the collection of taxes imposed on the use and business of motor boats. Up to this time it has not been feasible to determine the amount of revenue the inspection boats have collected or been instrumental in collecting. There is every reason to believe that it is considerably in excess of the cost of operation of our inspection boats.

MEDALS OF MERIT.

The passage of the bill (H. R. 13264) to provide for the award of a medal of merit to those in the American merchant marine who distinguished themselves during the war by extraordinary heroism, distinguished service in the line of their profession, or exceptionally meritorious service to the Government is again recommended. The bill has been favorably reported by the House Committee on the Merchant Marine and Fisheries, and, so far as I am aware, is cordially approved by all our maritime interests and by those generally interested in the suitable recognition of our merchant mariners, who had a large share in winning the war.

STEAMBOAT-INSPECTION SERVICE.

ORGANIZATION.

The following positions were embraced in the Steamboat-Inspection Service at the close of business on June 30, 1920:

At Washington, D. C.:		
Supervising Inspector General	1	
Deputy Supervising Inspector General (who is Acting Supervising Inspector General in the absence of that officer)	1	
Private secretary to the Supervising Inspector General	1	
Clerks	10	
Messenger	1	
		14
In the Service at large:		
Supervising inspectors	11	
Traveling inspectors	4	
Local inspectors of hulls	48	
Local inspectors of boilers	48	
Assistant inspectors of hulls	92	
Assistant inspectors of boilers	94	
Clerks to boards of local inspectors	96	
		393
Total		407

Twenty-three permanent positions were added to the Service during the year, as follows:

One traveling inspector, with headquarters at Cleveland, Ohio.

One private secretary to the Supervising Inspector General, Washington, D. C.

The following assistant inspectors: One assistant inspector of hulls, San Francisco, Calif.; Portland, Oreg.; Jacksonville, Fla.; and Toledo, Ohio. One assistant inspector of boilers, New York, N. Y.; New Haven, Conn.; Baltimore, Md.; and Pittsburgh, Pa. One assistant inspector of hulls and one assistant inspector of boilers at Boston, Mass., and Buffalo, N. Y. Two assistant inspectors of hulls and one assistant inspector of boilers, Philadelphia, Pa. One assistant inspector of hulls and two assistant inspectors of boilers, Norfolk, Va., and Seattle, Wash.

There is one less clerk in the Service, due to the reorganization of the clerical force at Cleveland, Ohio.

The force inspected and certificated 8,051 vessels, with a total gross tonnage of 15,621,399, of which 7,736 were domestic vessels, with a

total gross tonnage of 12,741,807, and 315 were foreign passenger steam vessels, with a total gross tonnage of 2,879,592. Of the domestic vessels there were 6,418 steam vessels, 704 motor vessels, 23 passenger barges, and 591 seagoing barges. There was an increase of 644 in the total number of vessels inspected and an increase of 4,059,233 in the total gross tonnage of vessels inspected as compared with the previous fiscal year. Letters of approval of designs of boilers, engines, and other operating machinery were granted to 26 steam vessels, with a total gross tonnage of 600. There were inspected for the United States Government 82 hulls and 2,096 boilers. There were 2,417 reinspections of steam vessels, motor vessels, and barges.

Licenses were issued to 33,614 officers of all grades. There were examined for visual defects 11,324 applicants for license, of whom 108 were found color blind, or with other visual defects, and rejected. Certificates of service were issued to 18,478 able seamen, and 1,598 were rejected. Certificates of efficiency were issued to 8,323 lifeboat men, and 661 were rejected.

Steel plates for the construction of marine boilers to the number of 5,733 were inspected at the mills, and a large amount of other boiler material was inspected. There were examined and tested 226,110 new life preservers, of which number 3,009 were rejected.

The total number of accidents resulting in loss of life was 192. The total number of lives lost was 470, of which 42 were passengers. Of the lives lost 145 were from suicide, accidental drowning, and other causes beyond the power of the Service to prevent, leaving a loss of 325 as fairly chargeable to accidents, collisions, founderings, etc. There was a decrease of 73 in the number of lives lost as compared with the previous fiscal year. Passengers to the number of 368,870,327 were carried on vessels required by law to make report of the number of passengers carried. Dividing this number by 42, the total number of passengers lost, shows that 8,782,626 passengers were carried for each passenger lost. The number of lives directly saved by means of the life-saving appliances required by law was 911.

MAINTENANCE OF THE AMERICAN MERCHANT MARINE.

For some years the proposition of rehabilitating the American merchant marine has been discussed by all parties in interest. Today the American merchant marine has been rehabilitated, but the problem of maintaining it remains. While, on the one hand, it may be considered to have been a miraculous performance when the great ocean carrying fleet was built, yet, on the other hand, it will be a more difficult proposition, requiring constructive statesmanship,

to lay down the policy that shall be followed in order to keep under the American flag the ships that have been built. This means more than merely a law requiring that that be done. It means the following of a policy that will make it commercially practicable to keep these ships under the American flag.

There are certain things relating to the functions of the Steamboat-Inspection Service of this Department that may very seriously affect the commercial practicability of American ships, and in their proper places a brief discussion will be given of some of the things concerning the Steamboat-Inspection Service that have very vital relationship with the subject of the maintenance of the American merchant marine.

CLASSIFICATION OF VESSELS.

Merchant vessels are at present classified by private societies. There are good arguments why this should be so, but it is believed that it is a natural function of the Government to classify vessels and that this can be better and more effectively done by a bureau of the Government. That function would naturally belong to the Steamboat-Inspection Service of this Department, and it is believed that very excellent results would be obtained if a law were enacted imposing upon the Steamboat-Inspection Service the responsibility and the duty of classifying ships. By this is meant more than the inspection of vessels, as is at present the case. It is contemplated that, as part of the classification of vessels, the Government would follow up the entire construction of the vessel, boilers, and machinery at the yards. If it were required that, before vessels subject to inspection are built, blue prints, plans, and specifications should be submitted to the Steamboat-Inspection Service, those blue prints, plans, and specifications could be passed on by experts in the office of the Supervising Inspector General, and immediately there would be established beyond any question of doubt that a ship, when built and certificated, is absolutely safe, because the Government would be concerned not alone with the equipment of the vessel but also with its construction. While at present it may be claimed that, theoretically at least, the local inspectors of steam vessels have authority to pass on structural matters, and do to a certain extent, yet the true, scientific, and constructive manner in which to proceed is to have the plans of ships first approved by this Government bureau. This would be done without any cost to the shipbuilder or owner and would not be done in an arbitrary or autocratic manner, because the owner or builder would have the right to appear before the Supervising Inspector General and be heard in regard to certain changes which he believed should be made. The experts functioning in the office of the Super-

vising Inspector General would be carefully chosen and be guided by a code of construction that would be the very latest, embodying the best in all existing codes, and should at all times lead the maritime world in this respect.

As a result of the approval of these blue prints of hull construction in the office of the Supervising Inspector General there would result an absolutely uniform administration of the law. That which is true of hull construction is also true of boiler construction, for instead of having certain boilers approved, as at present, by the boards of local inspectors or by the Board of Supervising Inspectors, all boiler construction would be passed upon by experts in the office of the Supervising Inspector General, and the function of the local inspectors would then be to see that hulls and boilers were built according to the approved prints and not be permitted to express any opinion with reference to how they should be built.

It is true that it would be necessary to have a larger appropriation in order to employ the experts having the requisite knowledge to do this, and also additional inspectors specially qualified for field work appointed, who would follow up the construction, especially of hulls; but even if that be true, the results would be more than justified by the safe conditions which would be obtained and by the high standard that would be set for the American merchant marine.

BOILER PRESSURE.

Certain remedial legislation should be enacted for the benefit of marine-boiler manufacturers in regard to boiler pressure. This has been recommended before by the Supervising Inspector General and by the Department, and it is again submitted that sections 4418 and 4433, Revised Statutes, should be amended so as to bring them up to date and consistent with the best modern boiler practice. The purpose of the bill that has already been introduced with reference to this matter is to do away with the obsolete rule contained in the present law, which prescribes a working steam pressure for single-riveted joints that does not take into consideration the percentage of strength of the riveted joint and allows 20 per cent additional pressure for double-riveted joints, but which does not allow a greater working pressure for triple-riveted and quadruple-riveted, etc., lap and butt joints, for which greater working pressure should be allowed on account of the greater strength of the triple-riveted and other joints of greater strength than the double-riveted joints.

If the authority asked for in the bill that has already been submitted to Congress be granted, the board of supervising inspectors could prescribe rules that would meet the various conditions of boiler

construction, taking into consideration the percentage of strength of the various riveted joints.

Section 4418, Revised Statutes, with reference to hydrostatic test of boilers, should also be amended along the lines suggested in the bill, and all of which give the board of supervising inspectors the authority to make rules with reference to certain features of boiler construction that it does not now possess.

TRANSPORTATION OF DANGEROUS ARTICLES.

It is necessary that some amendment be made to the provisions of section 4472, Revised Statutes, with reference to the transportation of dangerous articles on steamers carrying passengers. It is not so much a matter to-day of forbidding the transportation of certain articles as of regulating their transportation, and it is very necessary, incident to the expansion of American trade in foreign parts, that this law should be made thoroughly modern in all respects, to the end that American shippers may be able to compete successfully with foreign competitors in regard to the transportation of certain so-called dangerous articles. Section 4472, Revised Statutes, as it at present reads, is obsolete, and there are certain dangerous things which can be transported to-day without restriction that should be regulated, and there are certain other commodities that may now be forbidden, or too rigorously regulated, that should be treated in a more liberal and generous fashion, which would result in an easier expansion of American trade; hence, the Department will submit at the next session of Congress a bill looking to the amendment of section 4472, Revised Statutes, for the reasons given above.

EXTENSION OF MOTOR-BOAT INSPECTION.

It is believed that the inspection of motor boats should be extended, by which is meant not that motor boats should be subjected to the same kind of inspection as large steamers, but that certain essential conditions present on all motor boats be looked after by inspectors of the Steamboat-Inspection Service and certificates of inspection issued. This would result in greater safety to the traveling public and in satisfaction as well to the owners of motor boats. The proposition may be opposed by the owners of motor boats on the theory that this would interfere with their liberty of action, which is not the intention of the Department, but the Department is determined to interfere with the desire of any person who seeks to construe liberty as license. Along the same lines it is the thought of the Department that the operators of motor boats should receive license after they shall have taken the necessary examinations, because a license issued without any

examination, as at present, has very little, if any, effect in preventing those not competent from obtaining such licenses. The examination for license as operator of motor boats should not, of course, be as rigorous as the examination for license as master of a great ocean ship, but there are certain fundamental things with reference to vision, knowledge of the pilot rules, machinery, etc., that should be known by every operator of a motor boat, and he should be required to prove that he knows it to the satisfaction of the local inspectors of steam vessels.

LICENSING OF OFFICERS.

The Steamboat-Inspection Service has made special efforts to improve the standard of examinations for licensed officers, and this has been especially true of licenses to engineers, and particular attention will be given at the next meeting of the Board of Supervising Inspectors to the matter of the examination of applicants for license as motor engineer. The Service has been collecting data in regard to this matter, which will be available at the next meeting of the Board of Supervising Inspectors. The internal-combustion engine has come to stay and is being more extensively used, and while at one time only motor boats of small tonnage used it, now great motor ships are being built and certificated, and, in order to keep abreast of maritime development, the Service realizes that it will be necessary to have its inspectors specially instructed along this line.

Too much can not be said in praise of the earnest efforts of inspectors to obtain competent licensed officers through their supervision of the examination of applicants for license, and, while it may be true that, incident to the pressure of war and the disorganization that goes with such conditions, men obtained licenses that may not have been as well qualified as those obtaining them in normal times, yet, in the main, good work has been done, and the licensed personnel of the American merchant marine will compare favorably with that of the merchant marine of any nation.

INADEQUATE APPROPRIATIONS.

Inadequate appropriations for this important branch of the Government have had their effect not only in the matter of the salaries of inspectors and clerks but also in the limited number of personnel that could be employed.

It is true that in 1918 the salaries of the inspectors were increased, but that increase was a flat proposition of giving increased salary to each and every inspector. It was not based upon any principle of reclassification of salaries of inspectors. The reclassification of the steamboat inspectors is something that is absolutely necessary in the

interest of efficiency. As a result of inadequate salaries, good men have left the Steamboat-Inspection Service, men whom it would have been well to have kept, but who, because they were offered greater compensation by private firms, felt that it was to their interest to accept those offers. This was a natural and human thing for them to do, but the Government has been the sufferer as the result. It is necessary, therefore, that there be larger appropriations, so that better salaries may be paid, in order that good men may be obtained and the morale of the Service be kept up, and also that larger numbers of inspectors may be employed, because increasingly the importance of reinspection is realized, and reinspection can not be made without men.

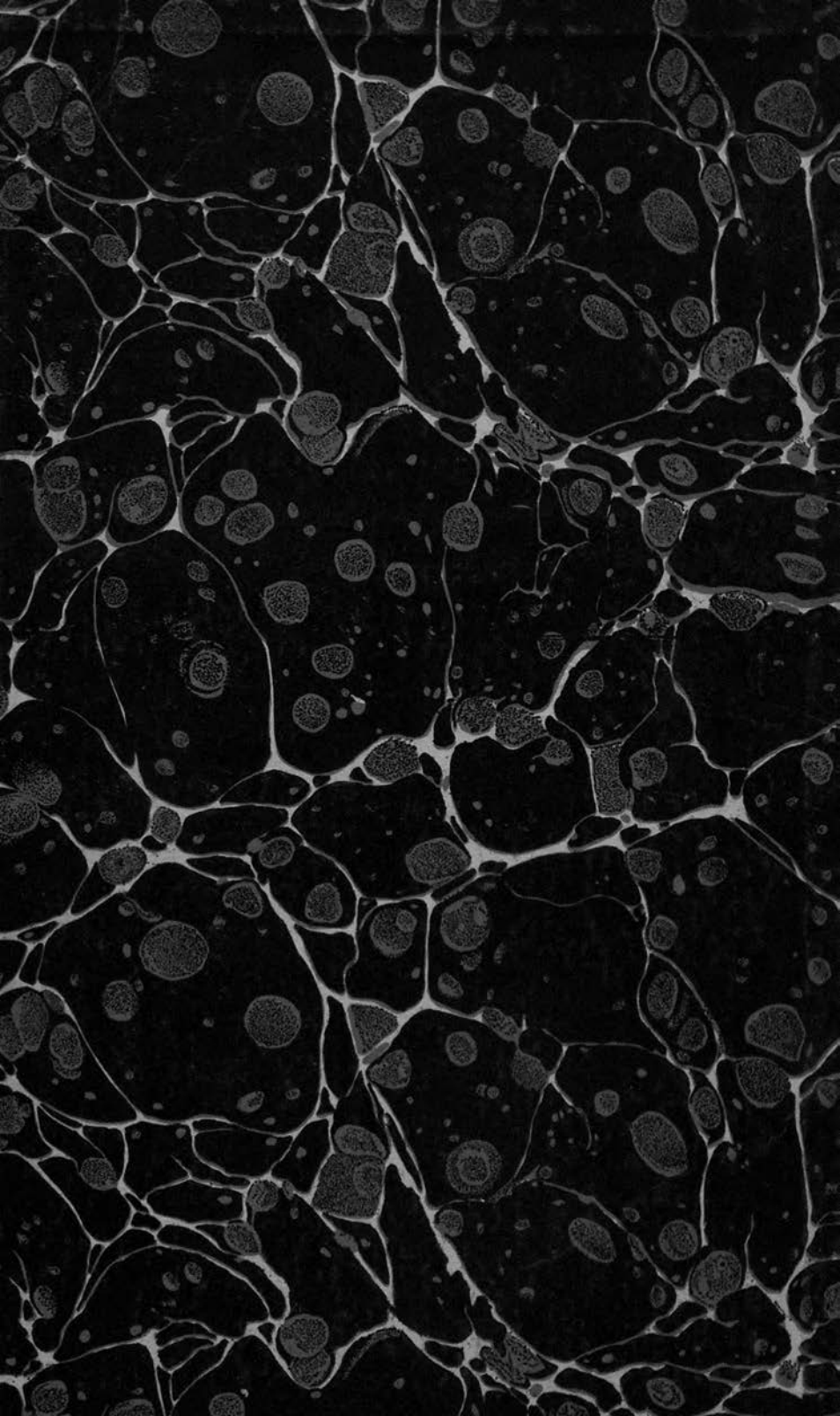
At present an even more serious condition exists with reference to the clerical force in this Service. Many of the best clerks have left and accepted offers in private establishments, and it is easily understood that this should be so when it is realized that the highest pay that may be paid to a field clerk is $1,500 per annum. Many private corporations offer as much as that to clerks entering their employ, whereas here is a branch of the Government offering that salary as the highest reward that may be given for efficient service, and many and long years of it. Again, notwithstanding repeated recommendations, Congress has failed to provide for an adequate number of clerks, with the result that in some important offices the work is congested and can not be gotten out as promptly as it should be, and in many others offices, where the work is turned out on time, it requires an unreasonably hard effort on the part of the clerical personnel to keep up with the current work. These conditions can and ought to be corrected by larger appropriations, and, unless they are, then it is only fair to state that this splendid arm of the Department is going to continue to suffer by the loss of efficient employees, all of which reduces the morale, and, in the last analysis, the public, which should be protected, suffers.

CONCLUSION.

The foregoing report is respectfully commended to your attention and to that of Congress.

Respectfully,

J. W. ALEXANDER,
Secretary.




DEPARTMENT OF COMMERCE
UNITED STATES OF AMERICA