ANNUAL REPORT
OF THE
SECRETARY OF COMMERCE
—
1921

ORGANIZATION OF THE DEPARTMENT.

[October 1, 1921.]

Secretary of Commerce	HERBERT HOOVER.
Assistant Secretary of Commerce	CLAUDIUS H. HUSTON.
Solicitor	WILLIAM E. LAMB.
Assistant to the Secretary	F. M. FEIKER.
Private Secretary to the Secretary	RICHARD S. EMMET.
Chief Clerk and Superintendent	EDWARD W. LIBBEY.
Disbursing Clerk	CHARLES E. MOLSTER.
Chief, Division of Appointments	CLIFFORD HASTINGS.
Chief, Division of Publications	THOMAS F. MCKEON.
Chief, Division of Supplies	FRANCIS M. SHORE.
Director of the Census	WILLIAM M. STEUART.
Director, Bureau of Foreign and Domestic Commerce	JULIUS KLEIN.
Director, Bureau of Standards	S. W. STRATTON.
Commissioner of Fisheries	HUGH M. SMITH.
Commissioner of Lighthouses	GEORGE R. PUTNAM.
Director, Coast and Geodetic Survey	E. LESTER JONES.
Commissioner of Navigation	DAVID B. CARSON.
Supervising Inspector General, Steamboat-Inspection Service	GEORGE UHLER.

CONTENTS.

NINTH ANNUAL REPORT

OF THE

SECRETARY OF COMMERCE.

DEPARTMENT OF COMMERCE,
OFFICE OF THE SECRETARY,
Washington, November 15, 1921.

To the PRESIDENT:

I have the honor to submit herewith, for transmission to Congress, in accordance with provisions of the organic act, the ninth annual report of the Secretary of Commerce. I attach hereto formal reports of the different bureaus, showing the scope and character of their work and expenditures during the fiscal year in question.

As I assumed office on March 4, 1921, this report covers but four months of the administration of the Department under my direction. The new administration during this four months devoted itself to two primary questions:

First. Reorganization of the departmental expenditures.

Second. Reorganization of those bureaus concerned with industry and trade, that they may become of more effective service to the community.

The results of reorganization enabled a revision of the estimates of expenditure for the fiscal year 1921–22, so that while the total appropriations available for the Department for this period are $24,222,192, yet it now seems probable that the expenses during this fiscal year will approximate $20,200,000, showing a total saving of about $4,000,000, or 16⅔ per cent, of the available appropriations.

The above economies should be accomplished notwithstanding the transfer of some savings and some supplemental appropriations to bureaus whose services to the public required expansion if they were to give full effectiveness.

The results of reorganization of the bureaus concerning industry and trade are in part indicated by the increase in volume of demand upon the Department for helpful action or information. These demands have now reached a rate of over 500,000 per annum.

The further practical results to American commerce and industry will be more evident later in the year and comment upon them can best be deferred until results have been further realized.

The establishment of a real Department of Commerce, effective in service to the producers, manufacturers, and distributors of commodities, able to give economic interpretation of importance to the American public generally, to stimulate American trade and merchant marine, requires a thorough reorganization and entire regrouping of the Federal functions bearing upon these problems. Inasmuch as these matters are now actively before Congress and the administration it is not necessary on this occasion to enter upon discussion of them.

Yours faithfully,

HERBERT HOOVER,
Secretary of Commerce.

Appendix A.—REPORTS OF ADMINISTRATIVE DIVISIONS OF THE OFFICE OF THE SECRETARY.

With the greatly increased demands of business upon the Department of Commerce, force is lent to the recommendations that have been made in preceding reports regarding new buildings, travel allowances, and other administrative detail. The Department is essentially a business organization, its staff is made up largely of men drawn especially from active commercial pursuits, and to render the highest service they should work under businesslike conditions. Moreover, the Department as it develops will become more and more the natural headquarters of American business and its needs for buildings and personnel should be interpreted in that spirit.

GOVERNMENT-OWNED BUILDING FOR THE DEPARTMENT.

Among the greater needs of the Department is a Government-owned building to properly house its various and increasing activities.

The Commerce Building houses the immediate Office of the Secretary and the several divisions thereof, which consist of the Assistant Secretary's office, Solicitor's office, Chief Clerk's office, Disbursing Clerk's office, Appointment Division, Division of Publications, Division of Supplies, Library, and the Stock and Shipping Section; also part of the Bureau of the Census, part of the Bureau of Foreign and Domestic Commerce, the Bureau of Navigation, the Bureau of Lighthouses, and the Steamboat-Inspection Service.

This building is leased at an annual rental of $65,000. The Department began its tenancy on September 1, 1913, at an annual rental of $48,000. Later an addition to the building was erected and occupied by the Department on July 1, 1914, the combined rental being $65,000 per annum. To the close of the calendar year 1921 a total of $531,249.93 will have been paid in rent for this building.

While one of the cheapest rentals in the District of Columbia, it requires no argument to prove the wisdom of housing Government activities in Government-owned buildings. From an economical as well as an administrative point of view this should be done. The Commerce Building is overcrowded to such an extent that efficiency is greatly retarded. The Bureau of the Census, in addition to occu-

pying a portion of the Commerce Building, has quarters in building "D," a temporary structure erected for war needs. The division of statistics of the Bureau of Foreign and Domestic Commerce is also located in one of the temporary war structures, to the great inconvenience of the Bureau and the impairment of efficiency.

ARCHIVES BUILDING.

The growing need for a national archives building was forcibly emphasized on January 10, 1921, when fire of unknown origin in the basement of the Commerce Building destroyed a large quantity of valuable records of several bureaus of the Department.

The Department has records which if destroyed could not be replaced, and proper protection for them should receive the earnest consideration of the Congress. In addition to the present unsatisfactory manner in which these records are stored, they occupy space which could be used to advantage in connection with the increasing work of the Department.

As has been repeatedly mentioned in reports of my predecessors, these papers, possessing permanent value and historic interest, include census returns, statistical publications and reports going back as far as the year 1847, records of scientific inquiries, technical papers, shipping records, copies of documents of vessels from 1813 to date, and correspondence and records of rulings, etc., under the steamboat-inspection laws.

It should require no argument to justify the wisdom of erecting an archives building for the proper housing and protection of the valuable papers of all branches of the Government, many of which relate to the early history, growth, and development of the country, the loss of which would be nothing less than a calamity.

The public buildings act of March 4, 1913, authorized the preparation of a design for an archives building, and the Secretary of the Treasury was authorized to select a site.

TRAVEL ALLOWANCE.

Recommendations have hitherto often been made with regard to travel allowance. Under the most advantageous circumstances the present per diem allowance of $5 or $4 in lieu of subsistence compels employees traveling on Government business to defray their actual necessary expenses from personal funds. It is essential in the interests of the Department and of business it serves that the Department representatives keep in constant contact with industry. It therefore develops that the more useful the service rendered and the more active the individual in his work the greater is he penalized financially. The obvious unfairness of this arrangement needs

only to be stated to be recognized, and it is hoped that this condition may be remedied this coming year.

The Department is asking in its annual estimate for an increased allowance not to exceed $7 a day, which, if granted, will afford a much-needed relief. There is no desire for extravagance, and suitable regulations can be made to keep the expenditures within reasonable bounds.

ESTIMATES FOR FISCAL YEAR ENDING JUNE 30, 1923.

COMPARISON BETWEEN THE ITEMS OF ESTIMATES FOR THE DEPARTMENT OF COMMERCE SUBMITTED FOR THE FISCAL YEAR 1923 AND APPROPRIATIONS FOR THE FISCAL YEAR 1922.

Bureau.	Estimates, 1923.	Appropriations, 1922.	Increase.	Decrease.
OFFICE OF THE SECRETARY.				
Salaries	$226,250.00	$196,050.00	$30,200.00	.....
Contingent expenses	92,400.00	50,000.00	42,400.00	.....
Rent	68,500.00	68,500.00	.....	.....
Total	387,150.00	314,550.00	72,600.00	.....
LIGHTHOUSE SERVICE.				
Salaries, Bureau of Lighthouses	92,000.00	68,290.00	23,710.00	.....
General expenses	4,400,000.00	4,200,000.00	200,000.00	.....
Salaries of keepers	1,300,000.00	1,300,000.00	.....	.....
Salaries, lighthouse vessels	1,800,000.00	1,800,000.00	.....	.....
Salaries, Lighthouse Service	460,000.00	400,000.00	60,000.00	.....
Retired pay	80,000.00	75,000.00	5,000.00	.....
Public works:				
Vessels for general service	1,500,000.00	1,000,000.00	500,000.00	.....
Depot for fifth lighthouse district	275,000.00	.....	275,000.00	.....
Delaware Bay entrance, aids to navigation	138,000.00	.....	138,000.00	.....
Alaska, aids to navigation	125,000.00	.....	125,000.00	.....
Calumet Harbor, aids to navigation	66,000.00	.....	66,000.00	.....
Spectacle Reef light station	14,500.00	.....	14,500.00	.....
Cape Spencer, Alaska, light station	175,000.00	.....	175,000.00	.....
Newport, R. I., lighthouse depot	82,300.00	.....	82,300.00	.....
Radio fog-signal installations	50,000.00	.....	50,000.00	.....
Detroit, Mich., lighthouse depot	50,000.00	.....	50,000.00	.....
Raritan Bay, aids to navigation	100,000.00	.....	100,000.00	.....
Galveston Bay, aids to navigation	125,000.00	.....	125,000.00	.....
Hawaiian Islands, lighthouse depot	120,000.00	.....	120,000.00	.....
Depot for seventh lighthouse district	225,000.00	.....	225,000.00	.....
Potomac River, aids to navigation	90,000.00	.....	90,000.00	.....
Depot for eighth lighthouse district	132,750.00	.....	132,750.00	.....
Charleston, S. C., lighthouse depot	60,000.00	.....	60,000.00	.....
Virgin Islands, aids to navigation	50,000.00	.....	50,000.00	.....
Ludington, Mich., aids to navigation	70,000.00	.....	70,000.00	.....
Tampa Bay, Fla., aids to navigation	17,500.00	.....	17,500.00	.....
Keepers' dwellings, Goat Island, Calif.	16,500.00	.....	16,500.00	.....
Depot for second lighthouse district	85,500.00	.....	85,500.00	.....
San Juan, P. R., lighthouse depot	60,000.00	.....	60,000.00	.....
Ketchikan, Alaska, lighthouse depot	75,000.00	.....	75,000.00	.....

COMPARISON BETWEEN THE ITEMS OF ESTIMATES FOR THE DEPARTMENT OF COMMERCE SUBMITTED FOR THE FISCAL YEAR 1923 AND APPROPRIATIONS FOR THE FISCAL YEAR 1922—Continued.

Bureau.	Estimates, 1923.	Appropriations, 1922.	Increase.	Decrease.
LIGHTHOUSE SERVICE—continued.				
California, aids to navigation	$25,000.00		$25,000.00	
Florida coasts, aids to navigation	50,000.00		50,000.00	
Goat Island, Calif., lighthouse depot	68,000.00		68,000.00	
Sandusky, Ohio, aids to navigation	108,000.00		108,000.00	
Oswego, N. Y., aids to navigation	13,000.00		13,000.00	
Galveston Jetty light station		$6,500.00		$6,500.00
Total	12,099,050.00	8,849,790.00	3,255,760.00	6,500.00
Net increase			3,249,260.00	
BUREAU OF THE CENSUS.				
Salaries	915,330.00		915,330.00	
Collecting statistics	1,307,820.00		1,307,820.00	
Tabulating machines	40,340.00		40,340.00	
Expenses, Fourteenth Census		750,000.00		750,000.00
Total	2,263,490.00	750,000.00	2,263,490.00	750,000.00
Net increase			1,513,490.00	
BUREAU OF FOREIGN AND DOMESTIC COMMERCE.				
Salaries	251,380.00	232,510.00	18,870.00	
Promoting commerce	624,050.00	325,000.00	299,050.00	
Promoting commerce, South and Central America	253,650.00	100,000.00	153,650.00	
Promoting commerce, Far East	275,650.00	150,000.00	125,650.00	
Commercial attachés	275,800.00	171,000.00	104,800.00	
Export industries	545,000.00	250,000.00	295,000.00	
Total	2,225,530.00	1,228,510.00	997,020.00	
STEAMBOAT-INSPECTION SERVICE.				
Salaries, office of Supervising Inspector General	28,240.00	22,940.00	5,300.00	
Salaries, Steamboat-Inspection Service	636,900.00	692,850.00		55,950.00
Clerk hire	120,600.00	115,000.00	5,600.00	
Contingent expenses	180,000.00	160,000.00	20,000.00	
Total	965,740.00	990,790.00	30,900.00	55,950.00
Net decrease				25,050.00
BUREAU OF NAVIGATION.				
Salaries	48,880.00	42,780.00	6,100.00	
Salaries, Shipping Service	34,600.00	35,200.00		600.00
Clerk hire, Shipping Service	95,460.00	70,000.00	25,460.00	
Contingent expenses	10,240.00	10,000.00	240.00	
Admeasurement of vessels	4,500.00	3,760.00	740.00	
Instruments for counting passengers	250.00	250.00		
Preventing overcrowding of passenger vessels	18,000.00	15,000.00	3,000.00	
Enforcement of navigation laws	60,000.00	60,000.00		
Enforcement of wireless-communication laws	80,000.00	80,000.00		
Medals of merit to the merchant marine	13,000.00		13,000.00	

COMPARISON BETWEEN THE ITEMS OF ESTIMATES FOR THE DEPARTMENT OF COMMERCE SUBMITTED FOR THE FISCAL YEAR 1923 AND APPROPRIATIONS FOR THE FISCAL YEAR 1922—Continued.

Bureau.	Estimates, 1923.	Appropriations, 1922.	Increase.	Decrease.
BUREAU OF NAVIGATION—continued.				
Refunding penalties, etc	$3,000.00	$3,000.00		
Total	367,930.00	319,990.00	$48,540.00	$600.00
Net increase			47,940.00	
BUREAU OF STANDARDS.				
Salaries	522,560.00	432,360.00	90,200.00	
Equipment	95,000.00	95,000.00		
General expenses	75,000.00	75,000.00		
Improvement and care of grounds	10,000.00	10,000.00		
Testing structural materials	200,000.00	175,000.00	25,000.00	
Testing machines	35,000.00	30,000.00	5,000.00	
Fire-resisting properties	25,000.00	25,000.00		
Public-utility standards	100,000.00	85,000.00	15,000.00	
Miscellaneous materials	45,000.00	30,000.00	15,000.00	
Radio communication	40,000.00	30,000.00	10,000.00	
Color standardization	10,000.00	10,000.00		
Clay products	30,000.00	25,000.00	5,000.00	
Mechanical appliances	40,000.00	15,000.00	25,000.00	
Optical glass	25,000.00	25,000.00		
Textiles	25,000.00	15,000.00	10,000.00	
Sugar standardization	40,000.00	30,000.00	10,000.00	
Gauge standardization	40,000.00	40,000.00		
Mine scales	15,000.00	15,000.00		
Metallurgical research	50,000.00	40,000.00	10,000.00	
High temperature	10,000.00	10,000.00		
Sound investigation	10,000.00	5,000.00	5,000.00	
Industrial research	200,000.00	150,000.00	50,000.00	
Standardization of equipment	100,000.00	100,000.00		
Standard materials	10,000.00		10,000.00	
Internal-combustion engines	45,000.00		45,000.00	
Radioactive substances	10,000.00		10,000.00	
Testing large scales	40,000.00	40,000.00		
Total	1,847,560.00	1,507,360.00	340,200.00	
COAST AND GEODETIC SURVEY.				
Party expenses	820,361.00	524,280.00	296,081.00	
Repairs of vessels	97,400.00	75,000.00	22,400.00	
Pay, etc., officers and men	507,000.00	528,000.00		21,000.00
Pay, commissioned officers	614,755.25	527,000.00	87,755.25	
Salaries	442,310.00	303,110.00	139,200.00	
General expenses	100,000.00	100,000.00		
New launches	53,000.00		53,000.00	
Total	2,634,826.25	2,057,390.00	598,436.25	21,000.00
Net increase			577,436.25	

COMPARISON BETWEEN THE ITEMS OF ESTIMATES FOR THE DEPARTMENT OF COMMERCE SUBMITTED FOR THE FISCAL YEAR 1923 AND APPROPRIATIONS FOR THE FISCAL YEAR 1922—Continued.

Bureau.	Estimates, 1923.	Appropriations, 1922.	Increase.	Decrease.
BUREAU OF FISHERIES.				
Salaries	$488,300.00	$444,180.00	$44,120.00	
Pay, officers and crew of vessel, Alaskan service	26,000.00	26,000.00		
Miscellaneous expenses	576,000.00	599,000.00		$23,000.00
Seal and salmon fisheries	165,000.00	165,000.00		
Advisory committee	2,500.00	2,500.00		
Yes Bay station	7,000.00		7,000.00	
Gloucester, Mass., station	6,500.00		6,500.00	
Duluth, Minn., station	6,000.00		6,000.00	
Utilization of Pacific coast fishes	10,000.00		10,000.00	
Pollution of waters	7,500.00		7,500.00	
Expenses of U. S. Commission, seal herds	5,000.00		5,000.00	
Saratoga, Wyo., hatchery		10,000.00		10,000.00
Total	1,299,800.00	1,246,680.00	86,120.00	33,000.00
Net increase			53,120.00	
Printing and binding	550,000.00	325,000.00	225,000.00	
RECAPITULATION.				
Office of the Secretary	387,150.00	314,550.00	72,600.00	
Lighthouse Service	12,099,050.00	8,849,790.00	3,255,760.00	6,500
Bureau of the Census	2,263,490.00	750,000.00	2,263,490.00	750,000.00
Bureau of Foreign and Domestic Commerce	2,225,530.00	1,228,510.00	997,020.00	
Steamboat-Inspection Service	965,740.00	990,790.00	30,900.00	55,950
Bureau of Navigation	367,930.00	319,990.00	48,540.00	600.00
Bureau of Standards	1,847,560.00	1,507,360.00	340,200.00	
Coast and Geodetic Survey	2,634,826.25	2,057,390.00	598,436.25	21,000.00
Bureau of Fisheries	1,299,800.00	1,246,680.00	86,120.00	33,000.00
Printing and binding	550,000.00	325,000.00	225,000.00	
Total	24,641,076.25	17,590,060.00	7,918,066.25	867,050.00
Decrease			867,050.00	
Net increase			7,051,016.25	

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, 1921, 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, 1921, 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 reg-

ular duties, are required to travel constantly) from Washington to points outside of the District of Columbia during the fiscal year ended June 30, 1921, 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, 1921, 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 ending June 30, 1922, 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 for the fiscal year ended June 30, 1921:

Bureau.	Legislative act.	Sundry civil act.	Deficiency act.	Allotments, legislative act, May 29, 1921.
Office of the Secretary	$314,550.00		$68.25	
Bureau of the Census	5,000,000.00		2.00	
Coast and Geodetic Survey		$2,041,447.00	47,887.30	
Bureau of Fisheries		1,211,310.00	17,717.43	
Bureau of Foreign and Domestic Commerce	916,510.00		60.37	
Bureau of Lighthouses	67,290.00	7,770,000.00	543,465.01	
Bureau of Navigation	315,140.00		2.09	
Bureau of Standards	1,232,360.00	87,272.00	32,038.72	$366,192.00
Steamboat-Inspection Service	995,890.00		5,117.87	
Total	8,841,740.00	11,110,029.00	646,359.04	366,192.00
Increase of compensation	2,522,820.32			
Printing and binding		365,000.00		
Grand total	11,364,560.32	11,475,029.00	646,359.04	366,192.00

Bureau.	Allotments, fortifications act, May 21, 1921.	Special act.	Total.
Office of the Secretary			$314,618.25
Bureau of the Census			5,000,002.00
Coast and Geodetic Survey	$15,556.00		2,104,890.30
Bureau of Fisheries		$2,210.77	1,231,238.20
Bureau of Foreign and Domestic Commerce			916,570.37
Bureau of Lighthouses			8,380,755.01
Bureau of Navigation		6,182.02	321,324.11
Bureau of Standards	492,980.00		2,210,842.72
Steamboat-Inspection Service			1,001,007.87
Total	508,536.00	8,392.79	21,481,248.83
Increase of compensation			2,522,820.32
Printing and binding			365,000.00
Grand total	508,536.00	8,392.79	24,369,069.15

The disbursements by the authorized disbursing officers of the Department during the fiscal year ended June 30, 1921, arranged according to items of appropriation, are as follows:

By Disbursing Clerk, Department of Commerce.

OFFICE OF THE SECRETARY.

Contingent expenses, Department of Commerce, 1919	$125.54
Contingent expenses, Department of Commerce, 1920	18,322.48
Contingent expenses, Department of Commerce, 1921	79,344.97
Rent, Department of Commerce, 1920	5,958.34
Rent, Department of Commerce, 1921	62,191.68
Salaries, office of the Secretary, 1920	7,994.55
Salaries, office of the Secretary, 1921	178,803.92
National security and defense, electric railways investigation, 1919	380.29
National security and defense, waste-reclamation work, 1919	10.70
Total	353,132.47

BUREAU OF THE CENSUS.

Collecting statistics, 1919	203.89
Tabulating machines, 1919	121.25
Total	325.14

BUREAU OF FOREIGN AND DOMESTIC COMMERCE.

Commercial attachés, 1919	.48
Commercial attachés, 1920	19,049.38
Commercial attachés, 1921	15,436.50
Promoting commerce, Department of Commerce, 1919	102.33
Promoting commerce, Department of Commerce, 1920	25,618.66
Promoting commerce, Department of Commerce, 1921	94,280.42
Promoting commerce, Far East, 1919	.26
Promoting commerce, Far East, 1920	1,942.15
Promoting commerce, Far East, 1921	33,037.40
Promoting commerce, South and Central America, 1919	3.32
Promoting commerce, South and Central America, 1920	2,387.40
Promoting commerce, South and Central America, 1921	38,048.97
Salaries, Foreign and Domestic Commerce, 1920	8,335.21
Salaries, Foreign and Domestic Commerce, 1921	191,974.02
National security and defense, import and export statistics, 1919	9.00
Total	430,225.50

BUREAU OF STANDARDS.

Armament of fortifications, commerce transfer	7,060.39
Color standardization, 1919	118.25
Color standardization, 1920	976.15
Color standardization, 1921	8,944.77
Determining physical constants, 1920	167.00
Equipment, 1919	1,833.14

Equipment, 1920	$23,379.64
Equipment, 1921	59,824.15
Gauge standardization, 1919	1,177.47
Gauge standardization, 1920	4,747.37
Gauge standardization, 1921	40,121.42
General expenses, 1919	478.63
General expenses, 1920	19,051.08
General expenses, 1921	31,471.17
High-potential investigation, 1919	213.27
High-temperature investigation, 1920	2,691.13
High-temperature investigation, 1921	9,403.40
Equipping laboratory, 1919–20	5,355.15
Improvement and care of grounds, 1920	771.77
Improvement and care of grounds, 1921	8,215.85
Industrial research, 1919–20	23.91
Industrial research, 1920	97,323.91
Industrial research, 1921	313,277.74
Industrial safety standards, 1920	5,045.67
Investigation of clay products, 1920	1,684.81
Investigation of clay products, 1921	21,198.36
Investigation of fire-resisting properties, 1919	137.78
Investigation of fire-resisting properties, 1920	2,872.12
Investigation of fire-resisting properties, 1921	20,515.48
Investigation of mine scales and cars, 1918–19	101.10
Investigation of mine scales and cars, 1920	242.15
Investigation of mine scales and cars, 1921	8,848.18
Investigation of optical glass, 1919	68.75
Investigation of optical glass, 1920	7,933.93
Investigation of optical glass, 1921	25,771.27
Investigation of public-utility companies, 1918–19	6.49
Investigation of public-utility standards, 1919	634.38
Investigation of public-utility standards, 1920	6,251.51
Investigation of public-utility standards, 1921	83,389.81
Investigation of public-utility standards, 1921–22	6,808.34
Investigation of railway materials, 1920	1,039.42
Investigation of railway materials, 1921	13,096.00
Investigation of textiles, 1919	336.50
Investigation of textiles, 1920	230.48
Investigation of textiles, 1921	13,784.40
Additional land, 1921	47,272.00
Manufacture of arms, war transfer, 1921–22	13.75
Metallurgical research, 1920	3,666.57
Metallurgical research, 1921	23,046.09
Military research, 1918–19	4,721.07
Salaries, 1920	19,240.36
Salaries, 1921	394,638.03
Sound investigation, 1920	1,499.59
Sound investigation, 1921	5,892.81
Standardization of equipment, 1920	14,674.10
Standardization of equipment, 1921	6,215.12
Standard materials, 1920	1,308.49
Standardizing mechanical appliances, 1919	50.00
Standardizing mechanical appliances, 1920	13,156.09

Standardizing mechanical appliances, 1921	$28,757.47
Sugar standardization, 1919	695.82
Sugar standardization, 1920	1,486.97
Sugar standardization, 1921	30,615.23
Platinum and rare metals, 1920	1,596.32
Radio research, 1920	986.17
Radio research, 1921	26,686.70
Renewal of storage batteries, 1919	9,014.91
Retaining wall, 1920	114.05
Testing Government materials, 1920	17,700.86
Testing Government materials, 1921	18,996.19
Testing machines, 1919	2.14
Testing machines, 1920	2,660.28
Testing machines, 1921	28,072.02
Testing miscellaneous materials, 1920	2,467.11
Testing miscellaneous materials, 1921	26,685.89
Testing railroad scales, 1919	.95
Testing railroad scales, 1920	8,146.74
Testing railroad scales, 1921	35,465.42
Testing structural materials, 1919	46.55
Testing structural materials, 1920	24,553.30
Testing structural materials, 1921	115,338.03
National security and defense, military researches, 1919	620.57
National security and defense, Roberts by-product coke oven, 1919	.29
National security and defense, thermite investigation, 1919	39.91
Total	1,772,767.65

STEAMBOAT-INSPECTION SERVICE.

Clerk hire, 1920	9,613.59
Clerk hire, 1921	100,881.37
Contingent expenses, 1919	208.90
Contingent expenses, 1920	36,118.88
Contingent expenses, 1921	124,466.58
Salaries, Office of Supervising Inspector General, 1920	955.86
Salaries, Office of Supervising Inspector General, 1921	21,301.43
Salaries, Steamboat-Inspection Service, 1920	55,668.99
Salaries, Steamboat-Inspection Service, 1921	607,020.96
Total	956,236.56

BUREAU OF NAVIGATION.

Admeasurement of vessels, 1920	498.05
Admeasurement of vessels, 1921	2,750.12
Clerk hire, 1920	5,447.47
Clerk hire, 1921	60,719.81
Contingent expenses, Shipping Service, 1919	.56
Contingent expenses, Shipping Service, 1920	1,642.75
Contingent expenses, Shipping Service, 1921	7,437.46
Enforcement of navigation laws, 1920	18,546.78
Enforcement of navigation laws, 1921	70,286.62
Enforcement of wireless-communication laws, 1919	.95

Enforcement of wireless-communication laws, 1920	$5,920.87
Enforcement of wireless-communication laws, 1921	52,735.22
Preventing overcrowding of passenger vessels, 1919	20.89
Preventing overcrowding of passenger vessels, 1920	2,225.44
Preventing overcrowding of passenger vessels, 1921	15,299.08
Salaries, Bureau of Navigation, 1920	1,691.30
Salaries, Bureau of Navigation, 1921	38,934.08
Salaries, Shipping Service, 1920	2,546.10
Salaries, Shipping Service, 1921	30,132.77
Total	316,836.32

BUREAU OF FISHERIES.

Biological station, Mississippi River Valley	25,447.76
Biological station, Mississippi River Valley, 1920–21	4,783.82
Buildings and water supply, fur-seal islands, Alaska	9,621.03
Buildings and improvements, fur-seal islands, Alaska	773.00
Fish hatchery, Bozeman, Mont	5,472.83
Fish hatchery, Cold Spring, Ga	320.89
Fish hatchery, Cape Vincent, N. Y., 1920	5,183.79
Fish hatchery, Washington	33,576.13
Fish hatchery, Woods Hole, Mass., 1920–21	41,647.60
Fish hatchery, Wytheville, Va., 1920	511.94
Fish hatchery, St. Johnsbury, Vt	1,577.85
Fish hatchery, Wyoming	326.18
Trout hatchery, Berkshire, Mass	605.10
Developing aquatic sources of leather, 1921	1,176.94
Investigating damages to fisheries	350.01
Marine biological station, Florida	138.26
Miscellaneous expenses, 1919	423.60
Miscellaneous expenses, 1920	91,152.28
Miscellaneous expenses, 1921	508,012.81
Protecting seal and salmon fisheries, Alaska, 1919	7.28
Protecting seal and salmon fisheries, Alaska, 1920	5,928.67
Protecting seal and salmon fisheries, Alaska, 1921	138,018.27
Pay, officers and crew of vessel, Alaska fisheries service, 1920	1,325.00
Pay, officers and crew of vessel, Alaska fisheries service, 1921	7,001.67
Salaries, Bureau of Fisheries, 1920	27,944.43
Salaries, Bureau of Fisheries, 1921	373,515.09
National security and defense, demonstration plant, 1919	30.32
National security and defense, food-fish supply, 1919	6.78
Total	1,284,879.33

BUREAU OF LIGHTHOUSES.

Aids to navigation, Alaska	31.88
Aids to navigation, Chesapeake Bay, Md. and Va	87.28
Aids to navigation, Conneaut Harbor, Ohio	80.90
Aids to navigation, Fairport Harbor, Ohio	111.05
Aids to navigation, Florida Reefs, Fla	47,148.00
Aids to navigation, Guantanamo Bay, Cuba	34.00
Aids to navigation, Pearl Harbor, Hawaii	2.30

Aids to navigation, St. Johns River, Fla	$190.36
Aids to navigation, Wash. and Oreg	7.52
Ambrose Channel, N. Y., lighted buoys	256.13
Fifth lighthouse district gas buoys	607.03
Joe Flogger Shoal Light Station, Delaware River	220.76
Point Boringuen Light Station, P. R	23.41
Point Jiguero Light Station, P. R	321.58
Execution Rock Light Station, N. Y	4.34
Manitowoc Breakwater Light Station, Wis	121.17
Diamond Shoal Light Vessel, N. C	120,625.36
Light-keeper's dwellings	248.64
Light vessels for general service	50,601.14
Light vessels for general lake service	14,742.80
Repairing and rebuilding aids to navigation, Atlantic coast	84.66
Repairing and rebuilding aids to navigation, Gulf of Mexico	48.36
Repairing and rebuilding aids to navigation, seventh and eighth lighthouse districts	376.54
Vessels for Lighthouse Service	322,758.00
General expenses, Lighthouse Service, 1919	4,545.73
General expenses, Lighthouse Service, 1920	22,830.98
General expenses, Lighthouse Service, 1921	46,860.25
Salaries, Bureau of Lighthouses, 1920	2,590.77
Salaries, Bureau of Lighthouses, 1921	59,881.47
Salaries, Lighthouse Service, 1920	225.00
Salaries, Lighthouse Service, 1921	5,270.83
Salaries, Lighthouse Vessels, 1921	8.91
National security and defense, aids to navigation, Caribbean Sea, 1919	22.29
Total	700,969.44

MISCELLANEOUS.

Increase of compensation, 1919	5.00
Increase of compensation, 1920	30,562.16
Increase of compensation, 1921	466,021.47
Total	496,588.63
Grand total	6,311,961.04

By disbursing officers, Lighthouse Service.

Aids to navigation, Alaska	9,630.65
Aids to navigation, Chesapeake Bay, Md. and Va	774.21
Aids to navigation, Atchafalaya Entrance Channel, La	437.76
Aids to navigation, Conneaut Harbor, Ohio	11,669.42
Aids to navigation, Fairport Harbor, Ohio	20,293.77
Aids to navigation, Fighting Island Channel, Detroit River, Mich	3 243.63
Aids to navigation, Guantanamo Bay, Cuba	972.37
Aids to navigation, Hudson River, N. Y	341.61
Aids to navigation, Indiana Harbor, Ind	10,846.53
Aids to navigation, Keeweenaw Waterway, Mich	611.50
Aids to navigation, Florida Reefs, Fla	47,148.00
Aids to navigation, St. Johns River, Fla	11,890.81
Aids to navigation, St. Marys River, Mich	29,447.61
Aids to navigation, Pearl Harbor, Hawaii	44,255.65
Aids to navigation, Washington and Oregon	8,245.76

Aids to navigation, Toledo Harbor, Ohio	$88.00
Aids to navigation, Mississippi River, La	114.78
Nantucket Harbor Fog-Signal Station, Mass	924.62
Depot for second lighthouse district	57,163.62
Depot for sixteenth lighthouse district	1,546.98
Staten Island Lighthouse Depot, N. Y	1 966.55
Woods Hole Lighthouse Depot	411.84
Fifth lighthouse district gas buoys	21,355.76
Light keepers' dwellings	9,535.50
Detroit Lighthouse Depot, Mich	3,865.02
Execution Rock Light Station, N. Y	6,143.30
Hunts Point Light Station, N. Y	1,065.35
Joe Flogger Shoal Light Station, Delaware River	8,419.89
Point Borinquen Light Station, P. R	22,721.00
Point Jiguero Light Station, P. R	13,231.36
Sand Hills Light Station, Mich	53.20
Sand Island Light Station, Ala	5.40
Spectacle Reef Light Station, Mich	391.20
Detroit River Lights, Mich	3,838.31
Diamond Shoal Light Vessel, N. C	8,156.00
Repairing and rebuilding, aids to navigation, Atlantic coast	74,213.73
Repairing and rebuilding, aids to navigation, Gulf of Mexico	16,061.13
Repairing and rebuilding, aids to navigation, seventh and eighth districts	56,551.27
Riprap protection for lighthouse station, third lighthouse district	19,055.65
Light vessel for general service	3 077.56
Tender and barge, eighth lighthouse district	15.39
Vessels for Lighthouse Service	17,013.43
General expenses, Lighthouse Service, 1919	20,864.98
General expenses, Lighthouse Service, 1920	556,517.43
General expenses, Lighthouse Service, 1921	3,521 293.11
Retired pay, Lighthouse Service, 1920	1,668.24
Retired pay, Lighthouse Service, 1921	67,172.09
Salaries, keepers of lighthouses, 1920	35,874.44
Salaries, keepers of lighthouses, 1921	1,258,715.11
Salaries, Lighthouse Service, 1920	3,713.50
Salaries, Lighthouse Service, 1921	377,416.30
Salaries, lighthouse vessels, 1920	75,370.23
Salaries, lighthouse vessels, 1921	1,784,893.72
National security and defense, aids to navigation, Caribbean Sea 1919	2,021.47
National security and defense, lighthouse depot, Tompkinsville, N. Y	57,367.39
Increase of compensation, Department of Commerce, 1920	22,821.33
Increase of compensation, Department of Commerce, 1921	853,979.60
Total	9,186,484.06

By special disbursing agent, Coast and Geodetic Survey.

Alteration of vessels transferred from Navy, 1921	4,673.84
Alteration of vessels transferred from Navy, 1920-21	1,407.86
General expenses, Coast and Geodetic Survey, 1919	121.75
General expenses, Coast and Geodetic Survey, 1919-20	5,874.65
General expenses, Coast and Geodetic Survey, 1920	16,845.43

General expenses, Coast and Geodetic Survey, 1921	$75,799.47
Party expenses, Coast and Geodetic Survey, 1919	730.92
Party expenses, Coast and Geodetic Survey, 1920	98,816.63
Party expenses, Coast and Geodetic Survey, 1921	381,987.22
Pay and allowances, commissioned officers, 1921	384,904.74
Pay, etc., of officers and men, vessels, 1920	80,553.91
Pay, etc., of officers and men, vessels, 1921	361,286.55
Repairs of vessels, Coast and Geodetic Survey, 1919	515.00
Repairs of vessels, Coast and Geodetic Survey, 1920	8,307.21
Repairs of vessels, Coast and Geodetic Survey, 1921	36,382.57
Salaries, Coast and Geodetic Survey, 1920	67,473.80
Salaries, Coast and Geodetic Survey, 1921	290,615.99
National security and defense, building equipment, 1919	2,935.00
Increase of compensation, 1919	30.00
Increase of compensation, 1920	13,544.13
Increase of compensation, 1921	130,191.79
Total	1,962,998.46

By special disbursing agents, Bureau of Fisheries.

Marine biological station, Florida	50.00
Miscellaneous expenses, Bureau of Fisheries, 1921	73.50
Pay, officers and crew of vessels, Alaska fisheries service, 1921	13,960.38
Protecting seal and salmon fisheries of Alaska, 1921	1,253.00
Increase of compensation, 1921	2,811.31
Total	18,156.19

By disbursing clerk, Bureau of the Census.

Expenses of the Fourteenth Census, 1920–1922	6,443,955.82
Increase of compensation, 1920	60,297.74
Increase of compensation, 1921	889,405.62
Total	7,293,659.18

By special disbursing agents, Bureau of the Census.

Expenses of the Fourteenth Census, 1920–1922	19,494.92

By special disbursing agents, Bureau of Standards.

General expenses, Bureau of Standards, 1921	1,027.73
Industrial research, 1921	1,967.68
Radio research, 1921	325.00
Standardizing mechanical appliances, 1921	455.09
Total	3,775.50

By commercial agents of the Department investigating trade conditions abroad.

Commercial attachés, 1920	2,014.91
Commercial attachés, 1921	138,016.05
Promoting commerce, Department of Commerce, 1920	792.25
Promoting commerce, Department of Commerce, 1921	183,037.82
Promoting commerce, Far East, 1921	58,333.80
Promoting commerce, South and Central America, 1921	44,829.15
Increase of compensation, 1921	5,075.39
Total	432,099.37

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, 1921, classified according to items of appropriation:

Office of the Secretary:	
Contingent expenses, Department of Commerce, 1919	$552.59
Contingent expenses, Department of Commerce, 1920	5,418.98
Contingent expenses, Department of Commerce, 1921	8,084.79
Certified claims—	
Contingent expenses, Department of Commerce, 1916	1.20
Contingent expenses, Department of Commerce, 1917	7.91
Contingent expenses, Department of Commerce, 1918	61.31
Total	14,126.78
Bureau of Foreign and Domestic Commerce:	
Commercial attachés, 1919	149.04
Commercial attachés, 1920	730.84
Commercial attachés, 1921	37.90
Promoting commerce, Department of Commerce, 1919	1,358.25
Promoting commerce, Department of Commerce, 1920	2,819.78
Promoting commerce, Department of Commerce, 1921	401.89
Promoting commerce, Far East, 1920	355.70
Promoting commerce, Far East, 1921	89.00
Promoting commerce, South and Central America, 1919	22.09
Promoting commerce, South and Central America, 1920	28.24
Promoting commerce, South and Central America, 1921	9.00
National security and defense, commodity experts, 1919	330.00
Certified claims—	
Commercial attachés, 1917	21.87
Promoting commerce, Department of Commerce, 1917	14.77
Promoting commerce, Department of Commerce, 1918	52.32
Total	6,420.69
Bureau of Standards:	
Equipment, 1920	992.28
Equipment, 1921	134.49
Gauge standardization, 1919	4.20
Gauge standardization, 1920	2.90
General expenses, 1919	11.67
General expenses, 1920	31,305.18
General expenses, 1921	14,714.61
High-temperature investigation, 1920	45.60
Investigation of clay products, 1919	12.59
Investigation of fire-resisting properties, 1920	65.00
Investigation of fire-resisting properties, 1921	437.24
Investigation of optical glass, 1919	18.91
Investigation of public-utility standards, 1920	308.85
Investigation of railway materials, 1920	4.74
Metallurgical research, 1920	166.91
Military research, 1918–19	4,574.91

Bureau of Standards—Continued.	
Radio research, 1920	$82.45
Sound investigation, 1920	252.52
Sound investigation, 1921	61.73
Standardizing mechanical appliances, 1920	556.50
Testing machines, 1919	7.78
Testing machines, 1920	2,146.73
Testing machines, 1921	38.40
Testing railroad scales, 1919	71.85
Testing railroad scales, 1920	92.41
Testing railroad scales, 1921	3.80
Testing structural materials, 1919	99.55
Testing structural materials, 1920	793.57
Testing structural materials, 1921	2.46
Equipping laboratory, 1919–20	103.95
Industrial research, 1920	818.50
Industrial research, 1921	829.37
Industrial safety standards, 1920	17.78
Retaining wall, 1920	1,695.25
Standardization of equipment, 1921	205.25
Testing Government materials, 1920	251.09
National security and defense, Roberts by-product coke oven, 1919	11,790.00
National security and defense, military researches, 1919	99.29
Certified claims—	
Equipping chemical laboratory, 1916–17	12.00
Gauge standardization, 1917–18	50.87
General expenses, 1916	2.01
General expenses, 1917	6.20
General expenses, 1918	4.87
Military research, 1917–18	600.40
Investigation of public-utility standards, 1917	6.86
Investigation of public-utility standards, 1918	5.36
Testing railroad scales, 1915	59.34
Testing railroad scales, 1916	6,035.21
Testing structural materials, 1918	181.78
National security and defense, metallurgical work, 1918	69.38
National security and defense, Roberts by-product coke oven, 1918	10,012.00
Total	89,866.59
Bureau of Navigation:	
Refunding penalties or charges erroneously exacted	6,526.86
Contingent expenses, Shipping Service, 1920	19.24
Contingent expenses, Shipping Service, 1921	1.92
Enforcement of navigation laws, 1920	2,858.91
Enforcement of navigation laws, 1921	12.54
Enforcement of wireless-communication laws, 1920	25.36
Enforcement of wireless-communication laws, 1921	27.92
Certified claims—	
Enforcement of wireless-communication laws, 1918	2.09
Total	9,474.84

Steamboat-Inspection Service:	
Contingent expenses, 1919	$244.20
Contingent expenses, 1920	322.76
Contingent expenses, 1921	287.44
Certified claims—	
Contingent expenses, 1917	13.04
Contingent expenses, 1918	41.83
Total	909.27
Bureau of Fisheries:	
Biological station, Mississippi River Valley, 1921	5.61
Fish hatchery, Bozeman, Mont.	245.82
Fish hatchery, Cape Vincent, N. Y., 1920	100.79
Marine biological station, Fla.	23.31
Miscellaneous expenses, 1919	5,900.84
Miscellaneous expenses, 1920	20,293.91
Miscellaneous expenses, 1921	6,527.71
Protecting seal and salmon fisheries of Alaska, 1920	1,733.33
Protecting seal and salmon fisheries of Alaska, 1921	269.74
Salaries, Bureau of Fisheries, 1920	90.00
Certified claims—	
Miscellaneous expenses, 1916	52.83
Miscellaneous expenses, 1917	8.23
Miscellaneous expenses, 1918	10.40
National security and defense, food-fish supply, 1918	.27
Total	35,262.79
Bureau of the Census:	
Tabulating machines, 1919	.37
Expenses of Fourteenth Census, 1920–1922	356,292.66
Certified claims—	
Expenses of Thirteenth Census, 1910–1912	2.00
Total	356,295.03
Coast and Geodetic Survey:	
Motor-driven vessel and launches, 1919	2,270.98
General expenses, 1919	.25
General expenses, 1920	861.04
General expenses, 1921	2,919.25
General expenses, 1919–20	200.00
Party expenses, 1919	6,892.77
Party expenses, 1920	52,156.32
Party expenses, 1921	3,686.78
Pay, etc., officers and men, vessels, 1920	233.77
Repairs of vessels, 1919	13,593.27
Repairs of vessels, 1920	19,654.72
Repairs of vessels, 1921	4,548.73
Certified claims—	
General expenses, 1916	22.00
General expenses, 1918	19.44

Coast and Geodetic Survey—Continued.	
Certified claims—Continued.	
Party expenses, 1917	$37.83
Party expenses, 1918	921.43
Total	108,018.58
Bureau of Lighthouses:	
Aids to navigation, Alaska	251.49
Aids to navigation, Atchafalaya Entrance, La	1,642.83
Aids to navigation, Conneaut, Ohio	428.53
Aids to navigation, Guantanamo Bay, Cuba	265.50
Aids to navigation, Washington and Oregon	53.20
Kellett Bluff Light Station, Wash	469.98
White Shoal Lake Light Station, Mich	1,954.82
Light vessel, Southwest Pass, Mississippi River, La	1,613.90
Riprap protection for light stations, third lighthouse district	9,000.00
Radio installations on lighthouse tenders	8,851.45
Repairing and rebuilding aids to navigation, Gulf of Mexico	4,708.79
Repairing and rebuilding aids to navigation, seventh and eighth lighthouse districts	1,675.37
Tender for first lighthouse district	10.60
General expenses, Lighthouse Service, 1919	364,174.85
General expenses, Lighthouse Service, 1920	288,542.35
General expenses, Lighthouse Service, 1921	92,268.98
Salaries, Bureau of Lighthouses, 1920	72.22
Salaries, keepers of lighthouses, 1921	85.00
Salaries, lighthouse vessels, 1919	2,314.80
Salaries, lighthouse vessels, 1920	8,691.21
Salaries, lighthouse vessels, 1921	5,426.36
National security and defense, aids to navigation, Caribbean Sea, 1919	160.00
Certified claims—	
General expenses, Lighthouse Service, 1916	53.51
General expenses, Lighthouse Service, 1917	15,413.92
General expenses, Lighthouse Service, 1918	45,568.05
Salaries, lighthouse vessels, 1918	3,003.54
Total	856,701.25
Miscellaneous:	
Increase of compensation, 1920	36.00
Increase of compensation, 1921	20.00
Judgments, United States courts	2,210.77
Claims for damages by collision with lighthouse vessels	436.12
Total	2,702.89
Grand total	1,479,778.71

The following statement shows the expenditures during the fiscal year ended June 30, 1921, on account of all appropriations under the control of the Department, giving the total amount expended by each bureau:

Bureau.	By Disbursing Clerk of the Department.	By special disbursing agents of Department.	By Auditor for State and Other Departments.	Printing and binding.	Total.
Office of the Secretary	$392,038.16		$14,126.78	$13,524.35	$419,689.29
Bureau of the Census	325.14	$7,313,154.10	356,295.03		7,669,774.27
Coast and Geodetic Survey		1,962,998.46	108,018.58	36,873.02	2,107,890.06
Bureau of Fisheries	1,378,524.22	18,156.19	37,509.56	22,435.04	1,456,625.01
Bureau of Foreign and Domestic Commerce	481,288.60	432,099.37	6,420.69	163,918.99	1,083,727.65
Bureau of Lighthouses	708,638.67	9,186,484.06	857,157.37	25,413.38	10,777,693.48
Bureau of Navigation	356,336.30		9,474.84	44,107.45	409,918.59
Bureau of Standards	1,950,598.51	3,775.50	89,866.59	38,899.38	2,083,139.98
Steamboat-Inspection Service	1,044,211.44		909.27	19,825.56	1,064,946.27
Total	6,311,961.04	18,916,667.68	1,479,778.71	364,997.17	27,073,404.60

The following statement shows the expenditures during the fiscal year ended June 30, 1921, 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:

By the disbursing clerk, Department of Commerce, on account of salaries and expenses of the office of the Secretary of Commerce, the Bureaus of 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, the public works of the Lighthouse and Fisheries Services (shown in detail in the first of the foregoing tables of disbursements)	$6,311,961.04
By the authorized disbursing officers of the Lighthouse Service	9,186,484.06
By the special disbursing agent, Coast and Geodetic Survey	1,962,998.46
By the special disbursing agents, Bureau of Fisheries	18,156.19
By the commercial agents of the Department investigating trade conditions abroad, as special disbursing agents	432,099.37
By the disbursing clerk, Bureau of the Census	7,293,659.18
By the special disbursing agents, Bureau of the Census	19,494.92
By the special disbursing agents, Bureau of Standards	3,775.50
By warrants drawn on the Treasurer of the United States to satisfy accounts settled by the Auditor for the State and Other Departments	1,479,778.71
Printing and binding	364,997.17
Total	27,073,404.60

MISCELLANEOUS RECEIPTS.

Coast and Geodetic Survey: Sale of charts, publications, old property, etc	$50,333.86
Bureau of the Census: Sale of publications, etc	616.25
Bureau of Fisheries:	
Sale of 25,143 sealskins	1,128,953.13
Sale of fox and other skins	72,882.69

Bureau of Fisheries—Continued.	
Sale of fertilizer from Pribilof Islands	$523.36
Sale of seal oil	16.37
Meals furnished employees at isolated stations	4,107.36
Sale of old property	3,015.94
Bureau of Standards: Miscellaneous refunds	66.56
Steamboat-Inspection Service: Miscellaneous refunds	44.85
Bureau of Lighthouses: Sale of old property, rentals, etc	52,979.07
Office of the Secretary: Miscellaneous refunds	1.83
Bureau of Foreign and Domestic Commerce:	
Photostatic work done	234.41
Miscellaneous refunds	42.50
Bureau of Navigation:	
Tonnage duties	2,208,539.69
Navigation fees	225,822.89
Navigation fines	63,584.23
Miscellaneous refunds	14.25
Total	3,811,779.24

The following unexpended balances of appropriations were turned into the surplus fund June 30, 1921, in accordance with the act of June 20, 1874 (18 Stat., 110–111):

Salaries, Office of the Secretary of Commerce, 1919	$6,024.73
Increase of compensation, Department of Commerce, 1918	64.44
Increase of compensation, Department of Commerce, 1919	1,922.27
Increase of compensation, Department of Commerce, 1920	1,126.09
Rent, Department of Commerce, 1919	1,132.30
Contingent expenses, Department of Commerce, 1918	402.27
Contingent expenses, Department of Commerce, 1919	276.28
Salaries, Bureau of Census, 1919	57,387.51
Collecting statistics, Bureau of Census, 1918	18,100.18
Collecting statistics, Bureau of Census, 1919	32,969.84
Tabulating machines, Bureau of Census, 1918	5,437.83
Tabulating machines, Bureau of Census, 1919	18,944.58
Punching machines for Fourteenth Census, Bureau of Census, 1919	21,472.25
Salaries, Bureau of Foreign and Domestic Commerce, 1919	14,563.48
Commercial attachés, Department of Commerce, 1917	25.01
Commercial attachés, Department of Commerce, 1918	373.06
Commercial attachés, Department of Commerce, 1919	6,252.40
Promoting commerce, Department of Commerce, 1914	50.00
Promoting commerce, Department of Commerce, 1916	1.76
Promoting commerce, Department of Commerce, 1917	28.80
Promoting commerce, Department of Commerce, 1918	118.99
Promoting commerce, Department of Commerce, 1919	4,346.73
Promoting commerce, South and Central America, 1917	209.45
Promoting commerce, South and Central America, 1918	1,061.08
Promoting commerce, South and Central America, 1919	4,820.66
Promoting commerce in the Far East, 1919	9,358.55
Salaries, Office of Supervising Inspector General, Steamboat-Inspection Service, 1919	388.61
Salaries, Steamboat-Inspection Service, 1919	24,436.49
Clerk hire, Steamboat-Inspection Service, 1919	1,647.44

Contingent expenses, Steamboat-Inspection Service, 1918	$7,238.24
Contingent expenses, Steamboat-Inspection Service, 1919	1,809.44
Salaries, Bureau of Navigation, 1919	1,107.72
Salaries, Shipping Service, 1919	1,375.00
Clerk hire, Shipping Service, 1919	1,136.58
Contingent expenses, Shipping Service, 1919	87.69
Admeasurement of vessels, 1919	180.78
Preventing overcrowding of passenger vessels, 1919	193.42
Enforcement of navigation laws, 1919	28.62
Enforcement of wireless-communication laws, 1918	1.29
Enforcement of wireless-communication laws, 1919	861.13
Salaries, Bureau of Standards, 1919	57,497.13
Equipment, Bureau of Standards, 1919	5,089.91
General expenses, Bureau of Standards, 1918	334.06
General expenses, Bureau of Standards, 1919	1,340.45
Improvement and care of grounds, Bureau of Standards, 1919	214.18
Color standardization, Bureau of Standards, 1919	58.50
Determining physical constants, Bureau of Standards, 1919	27.82
Gauge standardization, etc., Bureau of Standards, 1917–18	2,418.81
Gauge standardization, etc., Bureau of Standards, 1919	4,880.14
Investigation of clay products, Bureau of Standards, 1919	233.56
Investigation of fire-resisting properties, Bureau of Standards, 1919	299.18
High-potential investigation, Bureau of Standards, 1918	52.59
High-potential investigation, Bureau of Standards, 1919	183.00
Investigation of mine scales and cars, Bureau of Standards, 1918–19	285.33
Investigation of optical glass, Bureau of Standards, 1919	2,210.26
Investigation of public-utility companies, Bureau of Standards, 1918–19	716.21
Investigation of public-utility standards, Bureau of Standards, 1918	7.00
Investigation of public-utility standards, Bureau of Standards, 1919	579.80
Investigation of railway materials, Bureau of Standards, 1919	141.36
Investigation of textiles, etc., Bureau of Standards, 1919	135.09
Military research, Bureau of Standards, 1917–18	10,164.85
Military research, Bureau of Standards, 1918–19	6,253.72
Radio research, Bureau of Standards, 1919	161.59
Radio laboratory, Bureau of Standards	38.15
Renewal of storage batteries, Bureau of Standards, 1919	1,304.23
Standardizing mechanical appliances, Bureau of Standards, 1919	88.21
Standard materials, Bureau of Standards, 1919	166.76
Sugar standardization, Bureau of Standards, 1919	576.87
Testing machines, Bureau of Standards, 1918	194.47
Testing machines, Bureau of Standards, 1919	771.23
Testing railroad scales, etc., Bureau of Standards, 1918	2.25
Testing railroad scales, etc., Bureau of Standards, 1919	2,173.90
Testing miscellaneous materials, Bureau of Standards, 1919	309.70
Testing structural materials, Bureau of Standards, 1918	2,883.37
Testing structural materials, Bureau of Standards, 1919	9,703.85
Salaries, Coast and Geodetic Survey, 1919	99,522.18
Party expenses, Coast and Geodetic Survey, 1919	31,476.02

General expenses, Coast and Geodetic Survey, 1918	$1,134.60
General expenses, Coast and Geodetic Survey, 1919	3,191.20
Pay, etc., officers and men, Coast and Geodetic Survey, 1919	68,761.53
Repairs of vessels, Coast and Geodetic Survey, 1919	2,101.86
Two new vessels, Coast and Geodetic Survey	455.39
Motor-driven vessel and launches, Coast and Geodetic Survey, 1919	50,890.41
Salaries, Bureau of Lighthouses, 1919	6,643.13
Retired pay, Lighthouse Service, 1919	7,664.67
General expenses, Lighthouse Service, 1915	2.27
General expenses, Lighthouse Service, 1916	22.39
General expenses, Lighthouse Service, 1917	55.04
General expenses, Lighthouse Service, 1918	9,239.78
General expenses, Lighthouse Service, 1919	109,591.73
Salaries, keepers of lighthouse, 1918	53.34
Salaries, keepers of lighthouse, 1919	46,921.27
Salaries, lighthouse vessels, 1918	9,066.67
Salaries, lighthouse vessels, 1919	46,522.75
Salaries, Lighthouse Service, 1918	196.41
Salaries, Lighthouse Service, 1919	12,019.44
Oil house for light stations	330.40
Dog Island Light, Me	381.46
Cape Cod Canal Lights, Mass	94.91
Woods Hole Lighthouse Depot, Mass	5.30
Aids to navigation, East River, N. Y	56.11
Ambrose Channel, N. Y., lighted buoys	.07
Hunt's Point Light Station, N. Y	226.74
Staten Island Lighthouse Depot, N. Y	1,144.51
Aids to navigation, Delaware River, Pa. and Del	63.20
Lighting Norfolk Harbor, Va	212.40
Thimble Shoal Light Station, Va	344.61
Aids to navigation, Lorain Harbor, Ohio	25.46
Manitowoc Breakwater Light Station, Wis	97.16
Cape St. Elias, Light Station, Alaska	200.16
Navassa Island, Light Station, West Indies	3,991.61
Salaries, Bureau of Fisheries, 1912	7.50
Salaries, Bureau of Fisheries, 1918	82.50
Salaries, Bureau of Fisheries, 1919	38,238.70
Miscellaneous expenses, Bureau of Fisheries, 1917	.60
Miscellaneous expenses, Bureau of Fisheries, 1918	5,621.83
Miscellaneous expenses, Bureau of Fisheries, 1919	1,583.95
Pay, officers and crew of vessels, Alaska fisheries service, 1919	5,375.84
Protecting seal and salmon fisheries of Alaska, 1918	1.95
Protecting seal and salmon fisheries of Alaska, 1919	285.33
Fish hatchery, Cold Spring, Ga	16.96
Fish hatchery, Edenton, N. C., 1919	798.35
Fish hatchery, St. Johnsbury, Vt	6.02
Fish hatchery, Utah	30.95
Trout hatchery, Berkshire, Mass	16.07
Total	923,233.25

National Security and Defense, Swedish iron ore	$2,780,351.68
National Security and Defense, export control	10.65
National Security and Defense, developing inland waterways	31.86
National Security and Defense, import and export statistics	7,888.56
National Security and Defense, industrial laboratory	24,842.80
National Security and Defense, metallurgical research	264.65
National Security and Defense, new building, Bureau of Standards	52.47
National Security and Defense, production of fabrics	701.35
National Security and Defense, production of optical glass	1,224.95
National Security and Defense, Roberts by-product coke oven	13,381.91
National Security and Defense, thermite investigation	4,146.08
National Security and Defense, food-fish supply	15,412.59
National Security and Defense, rescuing food fish	3,187.17
National Security and Defense, seal-oil plant	14.13
National Security and Defense, new building, Coast and Geodetic Survey	27,835.12
Total	2,879,345.97

National Security and Defense, import and export statistics	77.91
National Security and Defense, industrial laboratory	7,130.48
National Security and Defense, metallurgical work	320.73
National Security and Defense, production of optical glass	3,123.80
National Security and Defense, Roberts by-product coke oven	101.39
National Security and Defense, thermite investigation	187.82
National Security and Defense, food-fish supply	2,248.03
National Security and Defense, rescuing food fish	3,932.27
National Security and Defense, seal-oil plant	852.35
Total	17,974.78

National Security and Defense, Industrial Board, 1919	11,124.81
National Security and Defense, Industrial Cooperation Service, 1919	18,984.24
National Security and Defense, waste-reclamation work, 1919	12,482.97
National Security and Defense, commodity experts, 1919	85,467.88
National Security and Defense, import and export statistics, 1919	784.30
National Security and Defense, industrial laboratory, 1919	38.99
National Security and Defense, thermite investigation, 1919	353.25
National Security and Defense, Roberts by-product coke oven, 1919	251.58
National Security and Defense, altitude laboratory, 1919	102.81
National Security and Defense, completing laboratory, 1919	3,129.59
National Security and Defense, military researches, 1919	2,974.42
National Security and Defense, demonstration plant, 1919	6,885.00
National Security and Defense, food-fish supply, 1919	993.32
National Security and Defense, special statistical work, 1919	20,838.93
National Security and Defense, building equipment, 1919	144.20
National Security and Defense, new building, Coast and Geodetic Survey, 1919	2,620.40
National Security and Defense, aids to navigation, Caribbean Sea, 1919	23,707.69

National Security and Defense, lighthouse depot, Tompkinsville, N. Y., harbor, 1919	$9,558.19
Total	200,442.57
Armament of fortifications, commerce transfer	21,433.09
Aviation, Navy, commerce transfer, 1919	4.72
Total	21,437.81
Grand total	4,042,434.38

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

June 30, 1913	$618,970.01	June 30, 1919	$476,045.10
June 30, 1914	347,162.48	June 30, 1920	1,149,363.28
June 30, 1915	247,482.22	June 30, 1921	4,042,434.38
June 30, 1916	227,941.92		
June 30, 1917	177,995.27	Total	7,436,404.17
June 30, 1918	149,009.51		

PERSONNEL.

The accompanying table shows, by bureaus, the number of permanent positions in the Department on July 1, 1921, and the increase or decrease in each bureau as compared with July 1, 1920. 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 3,573, as compared with 4,234 for the fiscal year 1920. At the close of the fiscal year there were 751 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, 1921, was approximately 13,005, as compared with 18,249 on July 1, 1920.

Bureau.	Statutory.	Nonstatutory.	Total.	In District of Columbia.	Outside District of Columbia.	Increase (+) or decrease (−).
Office of the Secretary	183	.....	183	183	.....	.....
Bureau of the Census	636	2,564	[1] 3,200	[2] 2,436	764	−4,213
Bureau of Foreign and Domestic Commerce	156	177	333	[2] 213	120	+ 21
Bureau of Standards	342	523	865	838	27	− 35
Bureau of Fisheries	418	6	424	80	344	− 7
Bureau of Lighthouses	56	[3] 5,705	5,761	40	5,721	− 59
Coast and Geodetic Survey	338	525	863	[2] 360	503	+ 2
Bureau of Navigation	[4] 49	172	221	39	182	+ 4
Steamboat-Inspection Service	309	95	404	14	390	− 3
Total	2,487	9,767	12,254	4,203	8,051	−4,290

[1] The data for the Bureau of the Census includes 1,870 temporary Fourteenth Decennial Census positions which, under the law, must terminate on or before June 30, 1922; also 633 cotton agents employed in the field.

[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, appointment to which is not made by the head of the Department: 481 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.; 1,305 lamplighters; 227 light attendants, and 1,365 members of crews of vessels.

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

CHANGES IN THE PERSONNEL.

The following table gives a summary of changes in the personnel of the Department for the fiscal year ended June 30, 1921:

Bureau.	Appointments.[1]						Promotions.	Reductions.
	Permanent.				Temporary.	Grand total.		
	Competitive.	Excepted.	Unclassified.	Total.				
Office of the Secretary	46	3	9	58	8	66	32	.....
Bureau of the Census [2]	447	.....	945	1,392	4,390	5,782	7,703	1,146
Bureau of Foreign and Domestic Commerce	76	16	4	96	30	126	131	.....
Bureau of Standards	230	.....	24	254	390	644	515	.....
Bureau of Fisheries	46	12	18	76	80	156	93	3
Bureau of Lighthouses	397	5	.....	402	260	662	681	155
Coast and Geodetic Survey	64	1	5	70	50	120	205	3
Bureau of Navigation	43	12	21	76	68	144	76	3
Steamboat-Inspection Service	53	.....	1	54	15	69	42	3
Total	1,402	49	1,027	2,478	5,291	7,769	9,478	1,313

[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 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.

Bureau.	Separations.[1]						Miscellaneous changes.[2]
	From permanent positions.				From temporary positions.	Grand total.	
	Competitive.	Excepted.	Unclassified.	Total.			
Office of the Secretary	45	3	1	49	8	57	13
Bureau of the Census	1,602	.....	2,128	3,730	3,838	7,568	932
Bureau of Foreign and Domestic Commerce	51	16	2	69	9	78	44
Bureau of Standards	219	.....	5	224	417	641	124
Bureau of Fisheries	40	10	10	60	54	114	18
Bureau of Lighthouses	350	.....	.....	350	240	590	51
Coast and Geodetic Survey	36	6	24	66	72	138	14
Bureau of Navigation	21	1	21	43	118	161	19
Steamboat-Inspection Service	38	.....	.....	38	20	58	15
Total	2,402	36	2,191	4,629	4,776	9,405	1,230

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

[2] Includes reappointments by reason of change of station, name, designation, extension of temporary appointments, etc.

While the foregoing tables show a large reduction in turnover as compared with the report for 1920, from a business point of view it is still excessive, largely by reason of the difficulty of securing competent eligibles to accept the meager compensations of the lower-grade positions or to retain appointees therein when they learn the limitations as regards future promotions.

Although handicapped by conditions beyond its control, this Department has for some time maintained a general policy of filling vacancies in the higher grades by promotion, leaving the consequent vacancies in the lowest or entrance grades to be filled in each instance by new appointment, and other things being equal promotions are based on comparative efficiency and length of service.

In spite of promising prospects which have presented themselves from time to time for some years, salaries remain practically unchanged. It is true that the bonus is still paid and that the cost of living is slightly lowered, but no conclusion can be reached other than that the Government employee as a class is greatly underpaid for the qualifications he must possess and the work he has to undertake. This is still more apparent in the scientific and supervisory positions. The remaining of many such employees in the service may be attributed to personal ties formed, the dislike to break away from fixed habits of life, and loyalty to the service. The usual entrance salaries of clerks is $900 and $1,000 per annum (higher compensation is occasionally offered). A recent compilation of the average

salary of clerical employees of this Department showed it to be less than $1,250 per annum. A comparison of these figures not only presents the inadequacy of salaries offered, but the comparatively limited promotion opportunities as shown by the slight difference between the entrance salary and the average salary of experienced clerks. The trade workers of the Government and mechanical employees in the field service, where local conditions permit of equal competition, are getting wages equivalent to from $2,000 to $3,000 a year. Laborers can get wages approaching the average salaries of experienced clerks. If it is considered advisable to keep a low entrance salary there should be a sufficient proportion of the higher grades to permit prompt and reasonably frequent promotion scheme. Out of 1,000 clerical positions in this Department the compensation of 6 is over $2,000 per annum, of 152 between $1,500 and $2,000 per annum, of 577 between $1,000 and $1,500 per annum, and of 278 in grades below. It is expected that reclassification will remedy some of these drawbacks, but although for several years the question has been under consideration and considerable labor and expense have been devoted to it, reclassification does not appear to be appreciably nearer than it was a year ago. Various plans in the form of bills introduced into Congress are suggested, one desirable aim is common to all, the differences are secondary and should not be permitted to further postpone so advantageous a movement.

The annual study of leave statistics to ascertain the extent to which leave privileges were used by employees of the Department during the calendar year of 1920 shows that 26 per cent of the employees considered took no sick leave; 63 per cent took the full 30 days' allowance of annual leave; 14 per cent took the full 30 days' allowance of sick leave; 3 per cent took the combined allowance of 30 days each of annual and sick leave. Contrary to the popular belief, it is not the experience of this Department that employees are eager to avail themselves of the full use of leave privileges.

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TOTAL AND AVERAGE AMOUNT OF ANNUAL AND SICK LEAVE, BY BUREAUS, STATED SEPARATELY AND TOGETHER, TAKEN BY THE EMPLOYEES OF THE DEPARTMENT IN THE DISTRICT OF COLUMBIA, ARRANGED ACCORDING TO SEX, DURING THE CALENDAR YEAR 1920, AND AVERAGE LEAVE FOR 1919.

MALE.

Bureau.	Number.[1]	Annual leave.[2]		Sick leave.		Total.		Average, 1919.
		Days.	Average.	Days.	Average.	Days.	Average.	
Office of the Secretary	73	1,980	27.13	509	6.97	2,489	34.10	31.61
Bureau of the Census	282	7,696	27.29	1,203	4.27	8,899	31.56	30.66
Bureau of Foreign and Domestic Commerce	71	1,963	27.65	498	7.01	2,461	34.66	34.12
Bureau of Standards	455	11,622	25.54	2,673	5.88	14,295	31.42	29.45
Bureau of Fisheries	39	1,010	25.90	214	5.48	1,224	31.38	29.52
Bureau of Lighthouses	17	489	28.76	205	12.06	694	40.82	35.93
Coast and Geodetic Survey	158	4,396	27.82	1,236	7.82	5,632	35.64	35.40
Bureau of Navigation	15	395	26.33	73	4.87	468	31.20	29.53
Steamboat-Inspection Service	5	144	28.80	29	5.80	173	34.60	30.00
Total and average	1,115	29,695	26.63	6,640	5.96	36,335	32.59	31.11

FEMALE.

Office of the Secretary	55	1,586	28.83	788	14.33	2,374	43.16	39.18
Bureau of the Census	335	9,706	28.97	2,642	7.89	12,348	36.86	39.72
Bureau of Foreign and Domestic Commerce	54	1,590	29.44	544	10.07	2,134	39.51	40.88
Bureau of Standards	87	2,401	27.59	860	9.89	3,261	37.48	37.85
Bureau of Fisheries	23	675	29.35	264	11.48	939	40.83	37.82
Bureau of Lighthouses	3	88	29.33	58	19.33	146	48.66	48.00
Coast and Geodetic Survey	28	829	29.60	323	11.54	1,152	41.14	41.31
Bureau of Navigation	13	381	29.31	173	13.30	554	42.61	43.38
Steamboat-Inspection Service	6	180	30.00	60	10.00	240	40.00	36.00
Total and average	604	17,436	28.87	5,712	9.45	23,148	38.32	39.59

TOTAL.

Office of the Secretary	128	3,566	27.86	1,297	10.13	4,863	37.99	33.80
Bureau of the Census	617	17,402	28.21	3,845	6.23	21,247	34.44	33.76
Bureau of Foreign and Domestic Commerce	125	3,553	28.43	1,042	8.33	4,595	36.76	36.81
Bureau of Standards	542	14,023	25.87	3,533	6.52	17,556	32.39	30.61
Bureau of Fisheries	62	1,685	27.18	478	7.71	2,163	34.89	32.65
Bureau of Lighthouses	20	577	28.85	263	13.15	840	42.00	37.94
Coast and Geodetic Survey	186	5,225	28.09	1,559	8.38	6,784	36.47	36.49
Bureau of Navigation	28	776	27.71	246	8.79	1,022	36.50	36.46
Steamboat-Inspection Service	11	324	29.46	89	8.09	413	37.55	33.50
Total and average	1,719	47,131	27.42	12,352	7.19	59,483	34.61	34.11

[1] 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.

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

RETIREMENT.

For the period ending June 30, 1921, the Department under the provisions of the civil-service retirement act has retired 56 employees, 52 of these with annuities averaging $557.25, 4 without annuity. There are retained beyond retirement age 46 employees. The first year's operation of the retirement system has developed some of its shortcomings which should be amended. Among these may be mentioned the low rate of pension, which is insufficient to support an annuitant. Such a condition has a tendency to minimize one of the great advantages of the system. The superannuated employee is unwilling to retire, and out of consideration for him his superior officers may, against their good judgment, approve his retention beyond retirement age. It is understood that the cost of the system is much less than was anticipated, and it is hoped that favorable consideration may be given to the increase of the amount of annuities. An inequality in the act is that of compelling employees receiving over $1,200 per annum to contribute the usual percentage of the full amount of their compensation while the maximum annuity is that which might be earned by a $1,200 clerk. In all equity if such a limitation is placed on the annuity, a comparable limitation should be placed on the deductions from his salary. The matter of refundment of deductions to employees leaving the service has been a source of considerable trouble and delay. Under the law such deductions can be made only after reference to and the necessary operation in the immediate office of the employee, through the Department headquarters to the Civil Service Commission, thence to the Pension Office. Simplification and promptness would be secured if the refunds could be made by the disbursing officers by whom the deductions were made.

The Department has in operation a second retirement system for the field employees of the Lighthouse Service. This system is noncontributory, the pension being based upon the length of service and average salary during the last five years of service. Under this system 18 employees have been retired during the fiscal year with an average pension of $588.20 and 2 employees are being continued beyond retirement age.

PRINTING AND BINDING.

The cost of printing and binding for the Bureau of the Census during the decennial-census period (July 1, 1919–June 30, 1922) is paid for from the appropriation for the Fourteenth Census. For the printing and binding needs of the other bureaus, offices, and services of the Department for the fiscal year 1921 Congress allotted $365,000. Of this sum, $364,997.17 was expended.

The estimated cost of unbilled and uncompleted work of the Department at the Government Printing Office on July 1, 1921, and chargeable against the allotment for 1922, was $44,326.90, while such work at the Government Printing Office on the same date in 1920 actually cost $47,471.84.

The following table shows the cost of printing and binding for each of the services of the Department, exclusive of the Bureau of the Census, during the fiscal years 1920 and 1921, and the estimated cost of the work on hand but not completed on June 30, 1921:

Bureau, office, or service.	Cost of work.		Estimated cost of work not completed June 30, 1921.
	1920	1921	
Office of the Secretary (Secretary, Assistant Secretary, Solicitor, Chief Clerk, and Division of Publications)	$15,528.73	$11,785.75	$1,743.73
Appointment Division	446.77	398.76	108.47
Disbursing Office	622.65	759.20	29.94
Division of Supplies	505.98	580.64	94.07
Coast and Geodetic Survey	37,489.48	36,873.02	5,501.61
Bureau of Fisheries	15,263.51	22,435.04	2,534.65
Bureau of Foreign and Domestic Commerce	127,909.69	163,639.24	18,132.93
Bureau of Lighthouses	15,170.04	16,496.25	292.67
Lighthouse Service	5,507.22	8,917.13	1,389.93
Bureau of Navigation	23,830.95	24,987.71	18.39
Shipping Service	5,492.45	9,657.94	3,251.76
Radio Service	785.01	919.49	572.37
Bureau of Standards	29,930.54	38,899.38	5,224.99
Office of the Supervising Inspector General, Steamboat-Inspection Service	1,432.26	906.16	.....
Steamboat Inspection Service	14,199.64	18,919.40	3,288.11
Customs Service	5,881.05	8,822.06	2,143.28
Total	299,995.97	364,997.17	44,326.90
Expenditures chargeable against allotments from national security and defense fund:			
Industrial Cooperation Service	2,342.91	.....	.....
Import and export statistics	15,600.17	.....	.....
Total	17,943.08	.....	.....
Grand total	317,939.05	364,997.17	.....

The cost of each class of work during the fiscal years 1920 and 1921 is shown in the following statement:

Class.	1920	1921
Blank forms	$31,070.33	$30,410.40
Reports, pamphlets, etc.	257,092.13	296,215.67
Letterheads	3,465.74	3,630.30
Envelopes	127.52	150.70
Circulars, summaries, and notices	299.87	1,078.56
Index cards	1,632.39	261.79
Guide cards and folders	961.51	3,442.28
Memorandum sheets	1,424.62	343.36
Blank books	15,320.10	20,336.76
Miscellaneous books (binding)	5,361.69	7,526.66
Miscellaneous	1,183.15	1,600.69
Total	317,939.05	364,997.17

The publication work of each Bureau of the Department for the past two fiscal years is summarized in the following table:

Bureau or office.	Publications.		Pages.		Copies printed for Department.		Cost.[1]	
	1920	1921	1920	1921	1920	1921	1920	1921
Office of the Secretary	64	42	1,830	1,679	135,750	143,225	$5,862.01	$4,846.83
Bureau of the Census	55	137	8,631	4,600	1,398,951	482,319	160,862.76	96,510.62
Coast and Geodetic Survey	49	54	5,205	4,201	92,900	92,995	31,459.47	33,781.40
Bureau of Fisheries	59	49	1,034	3,047	57,400	72,950	10,800.70	22,483.44
Bureau of Foreign and Domestic Commerce	465	507	17,961	16,340	2,207,690	2,152,805	147,011.24	147,304.85
Bureau of Lighthouses	94	99	3,011	3,201	272,850	243,550	16,237.82	15,970.12
Bureau of Navigation	33	31	3,069	2,040	96,500	91,000	22,117.25	24,153.70
Bureau of Standards	135	119	5,196	5,818	240,350	181,900	24,498.97	33,120.39
Steamboat-Inspection Service	21	14	808	1,322	228,700	193,900	6,520.53	11,396.86
Total	975	1,052	46,745	42,248	4,731,091	3,654,644	425,370.75	389,568.21

[1] Figures relate to publications actually delivered to the Department during the year.

The Department continued to cooperate with the Superintendent of Documents in the distribution of its publications on a sales basis. There is increasing evidence that this method of distribution curtails extravagance and prevents wastefulness.

The following statement, compiled from figures furnished by the office of the Superintendent of Documents and the Coast and Geo-

detic Survey, shows the extent to which the Department's publications were sold during the past three fiscal years:

Sales.	Copies.			Receipts.		
	1919	1920	1921	1919	1920	1921
By Superintendent of Documents:						
Annual subscriptions	2,476,986	2,843,658	2,371,228	$19,301.10	$19,151.90	$17,934.40
Through miscellaneous sales	117,197	152,314	300,376	23,829.81	30,609.75	43,649.97
Total	2,594,183	2,995,972	2,671,604	43,130.91	49,761.65	61,584.37
By Coast and Geodetic Survey: Coast pilots, inside route pilots, tide tables, and charts				24,620.71	35,902.47	36,100.33
Grand total				67,751.62	85,664.12	97,684.70

DEPARTMENT LIBRARY.

With the increasing activities of the Department, there has been an insistent call upon the Department's library for service, even equaling the unusual demands of the war period. The library, containing approximately 100,000 volumes, is the depository for the material used in research work, and with its equipment and trained though insufficient personnel is a most important unit of the Department.

The year's record of additions to the library was 1,335 bound volumes and 894 pamphlets, compared with 1,277 bound volumes and 1,597 pamphlets during the previous year; 800 books were recatalogued and reclassed, 1,173 duplicates and discards were disposed of, thus providing space for more valuable material; 459 books were prepared for the bindery, 1,178 weekly and monthly periodicals and 53 official gazettes were currently received, recorded, and routed to the various bureaus. Books borrowed from the Library of Congress and other libraries numbered 485.

Extreme care is given to reviewing all material in order that it may be made available to those engaged in special research work. The library, in addition to being a most valuable adjunct to the Department, is recognized as one of the foremost reference libraries and is made use of not only by this Department but by other Government establishments and individuals.

WORK OF THE SOLICITOR'S OFFICE.

During the fiscal year ended June 30, 1921, 155 contracts totaling $850,608.74, together with 10 contracts of indeterminate amounts; 71 leases amounting to $106,998.75; 24 revocable licenses amounting to $2,120; 4 deeds in the sum of $62,648; 85 contract bonds amount-

ing to $196,756.69; 80 official bonds amounting to $495,500; and insurance policies amounting to $815,000, were examined (approved, disapproved, drafted, redrafted, or modified).

The number of legal opinions rendered, formal and informal (memorandum), totaled 267. Legislative matters handled, which concern the Department (drafting and redrafting of bills, reports relative thereto, etc.), numbered 17. Power of attorney cards, authorizing agents to execute official and contract bonds for surety companies examined totaled 3,600. In addition, 1,340 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.

Appendix B.—ABSTRACT OF REPORT OF THE DIRECTOR OF THE BUREAU OF THE CENSUS.

(WILLIAM M. STEUART, *Director.*)

DECENNIAL CENSUS WORK.

The fiscal year ended June 30, 1921, was the second of the three years which constitute the decennial-census period as defined by the Fourteenth Census act. Within this three-year period the reports on the comprehensive statistical inquiries covered by the census must, if the provisions of the law are carried out, be completed and published. This limitation of time, obviously designed to prevent delay or undue prolongation of census work and insure reasonably prompt publication of the results, was first introduced at the Twelfth Census, taken in the year 1900; and at that census the requirement of the law was practically, if not literally, carried out. But at the next census, that of 1910, the work was far from being completed within the census period; in fact, it was continued for more than a year afterwards.

Every effort is being made to complete the census within the three-year period in accordance with the requirements of law; and the present condition of the work and stage of progress now reached give me confidence that this purpose will be realized—at least to the extent of having the manuscript for the last of the reports in the hands of the printer by the close of the period. It is, however, by no means a simple matter, easy of accomplishment; and probably few persons other than those connected with the census realize the magnitude of the undertaking and the difficulties of carrying it to completion within the period prescribed by law. It involves the printing and distribution of 18,000,000 schedules of questions; the organization and supervision of a force of over 90,000 enumerators and special agents employed to make a house-to-house canvass of the entire United States—including all the outlying possessions except the Philippines and the Virgin Islands—and to fill out schedules for 107,500,000 people, 6,500,000 farms, and 450,000 manufacturing establishments; the punching of 300,000,000 tabulation cards; the running of the equivalent of over 2,000,000,000 cards through elec-

trical sorting and tabulating machines; the computation of several million percentages; the preparation of elaborate manuscript tables; and, finally, the printing and publication of 11 quarto volumes of about 1,000 pages each.

The enumeration of the population and the collection of the statistics of agriculture and manufactures for the Fourteenth Census gave employment to a field force of 94,140 supervisors, enumerators, special agents, and clerks. Virtually this entire force was selected, instructed, and organized, completed its work, and was paid and disbanded within 12 months. The expenditures for field work amounted to $11,479,390.

As the field work approached completion the office force was augmented, the peak being reached on August 31, 1920, when there were 6,301 employees, including statisticians, clerks, and machine operatives at work in the Bureau. This force was engaged in the examination and tabulation of the returns and in the preparation of the bulletins and reports.

The population of Continental United States, as reported for the census of 1920, was 105,710,620, an increase of 13,738,354 over the population in 1910. This increase in population was accompanied by increases in manufactures and agriculture, which added materially to the magnitude and complexity of the census work. The increase in the office work has been cared for by a larger number of clerks than at prior censuses, and also by the introduction of improved methods and the more general use of machinery.

In addition to Continental United States, the census covered Alaska, Hawaii, Porto Rico, Guam, Samoa, and the Panama Canal Zone. A census of the Virgin Islands was taken by the Census Bureau in 1917, and a census of the Philippine Islands was taken in 1918 under the authority of the local government.

TABULATION OF CENSUS DATA.

The tabulation and preparation for publication of the great mass of data returned on the millions of schedules secured by the enumerators and special agents occupied the attention of practically the entire force of the Bureau in Washington during the fiscal year. This work, of course, must be continued until the end of the census period, June 30, 1922. It is hoped that by that time the major portion of the Fourteenth Census reports will have been printed and distributed and that the manuscript for the remainder will be in the printing office.

Notwithstanding the great increase in our population and industries, there has been, on the whole, very little, if any, decrease in

the amount of detail covered by the census. There is a constant demand for specific information relative not only to the aggregate population but to the various elements composing this aggregate. While it is impossible for the Census Bureau to collect all the information desired, it endeavors to cover the more important inquiries; but if improved methods of tabulation had not been introduced, it would be impossible for the Bureau to tabulate and present the details now contained in its reports.

The schedules recording the answers to the various inquiries which were made regarding each individual, each farm, each irrigation or drainage enterprise, each manufacturing or forest-products establishment, and each mine, quarry, or oil or gas well were carefully examined by the clerks in the Census Bureau to detect errors, omissions, and inconsistencies. After this examination had been completed and the necessary corrections had been made—involving the return of the schedules in some instances—a card was punched for each person enumerated and for each farm, enterprise, establishment, etc., covered by the census. The holes punched in these cards enable the Bureau, by the use of electric machinery, to tabulate the figures and present the results in a great many instructive groupings and classifications. It required 301,255,417 punched cards to record for tabulation all the data obtained by the census, and in order to produce the various combinations and classifications of the statistics it was necessary for the cards to pass through the various machines more than once—in many instances 16 times. This machine work represents, therefore, the passage of the equivalent of 2,022,601,850 cards through the various sorting and tabulating machines.

Many of the machines used in this census were of a kind invented and developed by the employees of the Bureau—some were actually constructed in the Bureau's mechanical laboratory, and all the repairs and parts for replacement have been made in this laboratory. One or two inventors are now at work perfecting and improving these machines for use at subsequent censuses and for use by the Federal Government generally in the tabulation of statistics. I consider it very important that the machinery accumulated in the Census Bureau should be utilized in the class of work for which it is especially designed; and I am of the opinion, therefore, that so far as possible the statistical work of the Federal Government should be concentrated in this Bureau, and the construction and development of machinery of this class be encouraged and continued during the periods intervening between censuses.

The work on population and vital statistics required 35 high-speed electric tabulators, capable of operating at the rate of 400 cards per minute and recording 60 items at a time on each card. These are

owned by the Census Bureau. In addition, the Bureau has rented from the Tabulating Machine Co. 79 sorting and 78 tabulating machines; has rented, purchased, or constructed 1,544 card-punching machines; and has purchased 122 adding and calculating machines to supplement the 152 already owned, to say nothing of the large number it has been necessary to rent from time to time. Many of the machines have been in operation on two shifts, day and night. With this equipment the Bureau was able to make much more rapid progress in the tabulation of the data than at any preceding census. I feel that the purchase and use of similar equipment by other Federal offices in Washington should be discouraged, and that all statistical work of any magnitude in which machinery can be utilized to advantage should be concentrated in the Census Bureau.

REDUCTION OF THE FORCE.

No other branch of the Government, in times of peace, has as difficult a problem of organization, rapid work, and disbandment as the Census Bureau. Since the fall of 1919 more than 100,000 people have been appointed, instructed, supervised so as to rush the work, notwithstanding the short term of employment, and then discharged. When I was placed in charge of the Department, the Bureau had passed through most of these stages of its work and had arrived at what, in some respects, is the most difficult period, as it involves the completion of its reports and the dispensing with the services of the best, most skillful, and most highly trained of its temporary employees. At my request the Director has adopted what seems to me to be an equitable and businesslike method of procedure for the dismissal of the remaining employees who can not be passed into the regular staff of the Bureau when the census period is over.

THE APPORTIONMENT.

The enumeration of the population for the purpose of establishing the number of representatives each State shall have in Congress is the main purpose of the census referred to in the Constitution. The State totals for use as a basis for the apportionment were furnished to Congress in ample time to meet all its requirements. The Census Bureau also assisted the committees of the Senate and House of Representatives in devising various methods of apportionment that could be used and in preparing apportionment tables. As a result two bills have been introduced by the Census Committee of the House. The first, which was introduced at the Sixty-sixth Congress but failed of enactment, fixed the number of Representatives at 483. The second, recently introduced at the special session of the Sixty-seventh Congress, provides for 460.

ANNUAL AND OTHER INQUIRIES NOT INCLUDED IN THE DECENNIAL CENSUS.

In addition to the decennial-census work, the Bureau's duties include the conduct of annual inquiries covering State and municipal finances, and births and deaths in the registration areas; quarterly inquiries on tobacco stocks, and fats and oils; monthly inquiries as to stocks of hides and leather, active and idle wool machinery, number of active cotton spindles, consumption and stocks of cotton; and production, consumption, and stocks of cotton seed and cottonseed products; and semimonthly canvasses, made during the ginning season, to ascertain the amounts of cotton ginned to specified dates.

A MONTHLY SURVEY OF CURRENT BUSINESS.

During the latter part of the fiscal year I assigned to the Bureau the work of compiling statistics for a monthly report to show the current trends of business and industry throughout the country. This monthly report will, I believe, be very useful to the business public and in some measure furnish information which will help to stabilize industry.

VITAL STATISTICS.

For more than 20 years the Bureau has been fostering the adoption by State governments of an approved law for the registration of births and deaths. As rapidly as the States enact this law and give satisfactory evidence of adequate enforcement of its provisions, they are included in the Federal registration area. Largely through the efforts of the Bureau this area has been extended from year to year until for deaths it now contains 82.2 per cent of the population of the entire country, and for births 65.1 per cent. The collection of vital statistics is one of the most important of the regular annual investigations of the Bureau, and notwithstanding the great mass of work involved in the decennial census, it has been carried on without interruption during the census period. It is hoped that through the instrumentality of the Census Bureau all the States will eventually adopt the model law for the registration of births and deaths and will provide proper machinery for its enforcement.

The Bureau has published 20 annual reports giving detailed statistics of deaths in the various States and cities, 5 annual reports containing detailed statistics of births, and a volume of life tables showing expectation of life and other data for the population of certain States. In addition it has completed the copy for a second volume of life tables, which will comprise the original tables, certain tables for foreign countries, and a detailed explanation of the methods employed in computing the American tables. The Bureau also publishes the Weekly Health Index, which shows the total num-

ber of deaths, number of deaths of infants, and the infant-mortality rates for 66 large cities in the death-registration area.

FINANCIAL STATISTICS OF STATES AND CITIES.

Because of the heavy demands upon the resources of the Bureau in connection with the work of the decennial census, the regular annual compilation of statistics for the financial transactions of States and cities was omitted in 1920 and no report published for that year, but the work has now been resumed and data are being collected for the fiscal year 1921. The compilation of "official" statistics of cities by the Commissioner of Labor was authorized by act of Congress in 1898; and in 1903 this work was transferred to the Bureau of the Census. It has been the practice to have special agents visit each State and city and compile these statistics from the books of the auditors, tax collectors, and other financial officers, although when the act authorizing this inquiry was passed it seems to have been the expectation that the data could be compiled or abstracted from the published reports of city departments. But this was found impracticable because of the lack of uniformity in the reports and in many cases the lack of any reports whatever.

The work has now been carried on by the Bureau for about 18 years, and 23 detailed annual reports have been published. They cover the annual financial transactions of all States and of all cities with a population of 30,000 or over. The cities contend that the reports are of great value to them, having been of special assistance in the detection of antiquated methods and extravagant practices; and the statistics have been used extensively in the discussion of systems of taxation and have been of value in promoting the adoption of improved methods of accounting or other reforms.

If the financial statistics are of such value to the cities, it would seem that they should bear at least a part of the expense of the preparation of the reports; and acting on my instructions, the Director has made a radical change in the organization of this work and is arranging for the cities to furnish the data, thus effecting a considerable saving in the annual expenditures of the Bureau. The cities that do not attach sufficient importance to the statistics to justify them in supplying the data will be omitted from the reports. While such omissions will be unfortunate, I feel that the cities alone will be responsible, as the reports are primarily for their benefit.

The annual expenditures for the field work on this inquiry now amount to about $50,000. The cities have had ample time to adopt a standard classification of revenues and expenditures as recommended by the Bureau; and I am informed that there is no difference of opinion about the desirability of the adoption of such a classifica-

tion. Its adoption and the prompt response of the cities to the request of the Census Bureau for annual reports will insure the continuance of these valuable publications.

CENSUS PUBLICATIONS.

The value of census data is enhanced by their early publication, and every effort has been made at this census to publish the figures as promptly as possible. Within a short time after the receipt of the schedules containing the enumeration of the population in any defined area, such as a city or county, a preliminary count was made and the total population announced. The aggregate population for the entire country was announced on October 7, 1920, only a little more than nine months from the date (Jan. 2, 1920) on which the enumeration started.

The Bureau has been able to announce the figures at earlier dates, relatively, than at any preceding census. It has also adopted the policy of giving the public immediately, through the newspapers, the data obtained on various topics that have heretofore been buried in the voluminous final reports, which are not issued until near the end of the census period. Following this policy, it has distributed, as rapidly as the figures were available, short statements giving, for each State and for many counties and cities, the sex, nationality, age, school attendance, prevalence of illiteracy, occupation groups, and other features of the population, also statistics of agriculture, irrigation, drainage, manufactures, and mining. During the year there were distributed 6,218 statements of this character. These were mimeographed and given out to newspaper representatives in Washington, who, as a rule, telegraphed the facts to local papers throughout the country.

After the publication of the newspaper statements the figures for each State were assembled and published in printed bulletins. One hundred and twenty-one such bulletins, giving statistics of population, agriculture, irrigation, drainage, manufactures, and mining were published during the year. These bulletins had an aggregate edition of 325,350 copies. In addition there were published 132 statements and bulletins presenting the reports on the Bureau's regular annual, monthly, and semimonthly inquiries.

The copy for the first of the 11 quarto volumes that will constitute the final reports of the Fourteenth Census was sent to the printer before the close of the fiscal year, and will be ready for distribution at an early date. It shows the population of States, counties, cities, wards, towns, villages, townships, and other political subdivisions. It is the basic volume of the census reports, and the Bureau is to be congratulated upon its early publication. The remaining volumes

will consist in part of bound series of State bulletins, many of which have already been printed, while copy for the others is being sent the printer as rapidly as the figures can be established. In addition to the full reports an octavo abstract of about 1,000 pages will be issued. It is the desire of the Director of the Census to have the complete copy for all the reports in the Printing Office before June 30, 1922, when the census period of three years terminates. To accomplish this it has been necessary for him to depart in some important respects from the form of the publications of the Thirteenth Census. In making these changes he has had the advice and assistance of an advisory committee of eminent economists and statisticians.[1]

PRESERVATION OF RECORDS.

A fire in the Department building destroyed a portion of the census records, and a large part of these records is still stored in nonfireproof buildings. Their destruction, especially if it included the schedules of a census not yet completed, would result in a loss of many millions to the Government—one that it would be impossible to replace. The loss of the schedules of previous censuses can not, of course, be measured in terms of money, but in view of their value as historical records it would be a great and irreparable misfortune. A hall of records in which these documents can be stored and conveniently examined is most urgently needed.

The census schedules contain a vast amount of unpublished information that is of great value in studying the agricultural, industrial, and social conditions in various States and cities. The State governments of New York, Pennsylvania, and Arkansas, as well as the governments of some of our important cities, have at different times maintained corps of clerks in the Bureau to copy special material from these records. The Secretary of Agriculture has requested me to make a number of special tabulations and to furnish other material that will be of great assistance in the conduct of the various investigations of agricultural conditions now in progress in his department. The Bureau of Internal Revenue, the Bureau of Pensions, and other Federal offices are constantly calling on the Census Bureau for information from its schedules; and individuals and societies interested in genealogical and other research work are frequently requesting information contained in the returns of the earlier censuses. To satisfy these demands a corps of clerks is continually employed in searching the records.

[1] This committee consists of W. S. Rossiter, Dr. Edwin F. Gay, and Profs. Walter F. Willcox, Wesley C. Mitchell, Edwin R. A. Seligman, Carroll W. Doten, and Allyn A. Young.

COOPERATION WITH OTHER BUREAUS.

I have asked the director to negotiate with other statistical bureaus of the Federal Government with a view to minimizing duplication in statistical inquiries.

Many complaints have been received from manufacturers and others concerning the numerous requests made by Federal bureaus for statistical and other information. These complaints have been accompanied by the suggestion that it would greatly simplify the work of the Government and at the same time relieve business men of a great deal of annoyance if arrangements could be made for all the requests for statistical information to come through one office.

For many years the Bureau of the Census has been endeavoring to avoid duplication of investigations and at the same time to comply with the requirements of the law. Its work is duplicated to some extent, or at least inquiries are made for somewhat similar data, by a number of other bureaus, such as the Geological Survey, the Bureau of Mines, Bureau of Markets, Federal Trade Commission, United States Tariff Commission, Bureau of Chemistry, and Bureau of Crop Estimates. I feel confident that in many instances the periodic investigations of the Bureau of the Census are all that is necessary to make and that the investigations of other bureaus could, with advantage, be discontinued; or if such investigations are necessary, they should be assigned to the Bureau of the Census, which is especially equipped and organized for the collection and promulgation of statistical data.

RECOMMENDATIONS FOR CHANGES IN CENSUS LAWS AND METHODS.

The Director is of the opinion that in order to advance the work of subsequent censuses it will be necessary that changes be made in the methods of procedure, if not in the scope of some of the inquiries. For example: It would hasten the publication of the figures for the total population if the supervisors in the various districts made the preliminary count and announced the population, subject to correction, for the political subdivisions of their districts. Further, he is of the opinion that, so far as the statistics of population are concerned, it was a mistake to advance the date of the enumeration from April 15 (the Thirteenth Census date) to January 1. This change in the law was made at the request of the Department of Agriculture and of the various interests making use of agricultural statistics, the idea being that more accurate statistics could be obtained concerning the activities of the farms if the canvass was made shortly after the end of the year to which it related. The weather during January, however, is a serious handicap to the enumerator. In many instances

it delayed the work and made it necessary to take unusual precautions to insure a complete canvass.

MIDDECENNIAL ENUMERATION.

There was such a shifting of the population just prior to and following the census date that there has been considerable dissatisfaction with the result of the count. It has frequently been contended that the distribution of the population as shown by the reports of the Fourteenth Census is abnormal; that prior to the enumeration there was a great movement from rural to urban districts which since the enumeration has been neutralized in large measure by a reverse movement; and that this shifting of the population affected the totals for certain States, thus influencing the apportionment of Representatives in Congress. The Census Committee of the House is now considering the introduction of a bill providing for another enumeration of the population in 1925 or some other year prior to the next decennial census. This proposed legislation has my approval.

OFFICIAL REGISTER.

Since 1907 the Bureau of the Census has been compiling biennially a list giving the names of and information concerning the civilian employees of the Federal Government except those in the Postal Service. The preparation and publication of this Official Register now entails an expenditure of approximately $50,000. It seems to me that it answers no important purpose; certainly its value does not justify such an expenditure. I have accordingly recommended to Congress that a law be passed to discontinue the preparation of the Official Register after the publication of the edition for July 1, 1921, and to authorize the compilation and publication biennially by the Bureau of the Census of statistics of the civilian personnel of the Federal Government.

COTTON USED IN MANUFACTURE OF EXPLOSIVES.

The act of August 7, 1916, provides that "the Director of the Census shall collect and publish statistics of raw and prepared cotton and linters, cotton waste, and hull fiber consumed in the manufacture of guncotton and explosives of all kinds, and of absorbent and medicated cotton, during the year 1915 and quarterly thereafter, and the quantity held in such establishments at the end of each quarter." At the time this law was passed the consumption of cotton in the manufacture of explosives was so great that it had an effect on the price, and it was, therefore, important to know the quantities thus consumed. Such information, however, is no longer of value, and I recommend that this provision of the law be repealed.

Appendix C.—ABSTRACT OF REPORT OF THE DIRECTOR OF THE BUREAU OF FOREIGN AND DOMESTIC COMMERCE.

(JULIUS KLEIN, *Director.*)

DECREASE IN TOTAL VALUE OF FOREIGN TRADE.

Post-war conditions brought about a falling off in the total value of American trade from $13,347,340,777 in fiscal year 1920 to $10,170,764,776 in 1921.

Imports of merchandise totaled $3,654,449,430, as compared with $5,238,352,114 in 1920 and $4,095,720,068 in 1919. Domestic exports amounted to $6,385,636,039, against $7,950,429,180 in 1920 and $7,081,461,938 in 1919. The visible balance of trade in favor of the United States on merchandise transactions (not considering re-exports of foreign goods) was $2,731,186,609, as compared with $2,711,807,512 during 1920.

The slump in business, while heavy, has certain underlying causes which should be taken into consideration in analyzing the general situation. Part of the shrinkage in the totals of value is due to lower prices rather than to diminished quantities and part to the general unsettled conditions in the countries to whom the United States sells. It is, therefore, increasingly important that the services of the Bureau of Foreign and Domestic Commerce be developed and intensified to meet the increased demands of American manufacturers who are planning to hold and extend their markets abroad.

The exports of domestic and foreign merchandise to the several grand divisions during the fiscal year 1921 were as follows: Europe, $3,408,390,118; North America, $1,646,016,440; South America, $523,450,650; Asia, $547,247,117; Oceania, $257,181,813; Africa, $134,029,208; making a total of $6,516,315,346.

American sales to the United Kingdom registered a sharp decrease, from $2,151,115,428 in 1920 to $1,326,377,917 in 1921. Shipments to France were 40 per cent less in value and those to Italy 24 per cent less. Shipments to Belgium dropped from $317,112,688 to $184,533,430, while those to the Netherlands were about the same as during the preceding year. In terms of dollars, Germany bought more goods from the United States in the fiscal year 1921 than in the

pre-war year 1914, and the increase from 1920 to 1921 was $179,595,530—from $202,176,079 to $381,771,609.

Colombia, Ecuador, Paraguay, and Venezuela bought goods of less value from the United States than in the preceding year, but the other South American countries increased their purchases, the gain of $33,744,437 in the case of Argentina being particularly important. Our sales to Mexico increased 86 per cent in value.

There was a great falling off in the value of shipments to Japan—from $453,098,063 in 1920 to $189,181,551 in 1921. The figures for China, on the other hand, show an increase from $119,276,828 to $138,282,785. The increase for Australia and New Zealand, taken together, was more than 40 per cent.

CHANGES AMONG OFFICERS AND DIVISION CHIEFS OF BUREAU.

Roy S. MacElwee resigned as Director of the Bureau March 31, 1921, and was succeeded on June 22 by Julius Klein. Dr. Klein had previously been in the service of the Bureau; he was appointed expert in Latin American trade September 1, 1917; was chosen for the post of commercial attaché at Buenos Aires, Argentina, May 1, 1919; and resigned from the service October 31, 1920, to accept a professorship at Harvard University.

On December 31, 1920, L. E. Schmeckebier resigned as chief of the research division, accepting a position with the Institute of Government Research, and John K. Towles has since been acting as chief of that division. Fred W. Powell, chief of the Western Europe division, resigned November 15, 1920. Hugh D. Butler, chief of the foreign-service division, was promoted to trade commissioner at London November 9, 1920, and Harold Dotterer was promoted to succeed him.

GENERAL DEVELOPMENTS IN CONNECTION WITH FOREIGN SERVICE.

The commercial attachés and trade commissioners representing the Department abroad have done creditable work during the past year in their work of investigating and reporting economic developments, facilitating the foreign operations of American business men, and acting as commercial advisers to the diplomatic missions.

There were numerous changes in personnel at the various posts and the more important of these will be indicated in the succeeding pages. Five commercial attachés, 12 trade commissioners, and 2 assistant trade commissioners returned to the United States for conferences during the year. They visited commercial and industrial centers, addressing organizations and conferring with business men.

It is intended that each foreign office shall prepare a commercial handbook on the territory assigned to it; certain of these handbooks

have already been published, others are in course of preparation, while some are in a merely preliminary stage.

WESTERN AND NORTHERN EUROPE—BRITISH SOUTH AFRICA.

Lincoln Hutchinson, the commercial attaché formerly stationed in London, resigned on August 7, 1920, and Trade Commissioner Wilbur J. Page was in charge of the London office of the Bureau as acting commercial attaché until February 1, 1921, when he was succeeded by Commercial Attaché Alfred P. Dennis, who was transferred from Rome. Cordial cooperation has existed between the commercial attaché, the embassy, the Shipping Board, and the American military and naval attachés, while close relations have been established with the American Chamber of Commerce in London and the British Department of Overseas Trade. Trade Commissioner Page has specialized on British shipping and on the iron and steel industry and engineering trades, while Trade Commissioner Hugh D. Butler has studied textiles and the marketing of oils, resins, and fats. Through the intervention of the London office, the Ministry of Transport was induced to instruct the Great Western Railway to give better facilities for the shipment of china clay at the port of Fowey. Through the same ministry, the office was able to hasten the installation of unloading equipment at Fowey to facilitate the quick "turn around" of Shipping Board vessels at that point. Commercial Attaché Dennis secured the release of $200,000 worth of American securities that had been seized under a technicality by the British Trustee for Alien Property. Through his efforts, several orders for American coal were placed during the British strike.

Commercial Attaché William C. Huntington has been in charge at Paris, assisted by Trade Commissioner John F. Butler and Assistant Trade Commissioner Frederic G. Singer. The closest relations have been maintained with the International Chamber of Commerce, having headquarters in Paris. Commercial inquiries from both the United States and France increased materially. The attaché made an extensive trip through the devastated regions and, at the request of Gen. Allen, spent two weeks in the Rhineland studying the effect of a new customs barrier between occupied and unoccupied Germany.

The Copenhagen office, with Denmark, Norway, and Sweden as its field, has been in charge of Commercial Attaché Norman L. Anderson, assisted by Trade Commissioner Thormod O. Klath. Mr. Anderson was in the United States from July to November, 1920; he visited the main industrial centers. All significant developments relating not only to Scandinavia but also to Russia and Germany have been made the subject of reports from the Copen-

hagen office. Opportunities for American investment have been analyzed and individual inquiries and questionnaires from American firms have been handled. Trade complaints have been adjusted. Several economic reports have been prepared for the State Department. Mr. Anderson has made several trips of investigation to Norway and Sweden.

Since June, 1920, the Brussels office has been in charge of Trade Commissioner Samuel H. Cross, who was designated acting commercial attaché in February, 1921. Its data have been freely utilized by American business men in Belgium. Information has been exchanged with Belgian Government offices and the international bureaus centering in Brussels. Mr. Cross has made frequent visits to Belgium industrial and commercial centers. More than 400 special inquiries from American firms have been handled. Agents have been found for American products. Evidence has been secured as to the efficiency of American locomotives on Belgian lines. Visiting American business men and engineers have been aided. A survey of production costs and wages in Belgian industries is now being carried on, and representative plants have been visited. An extensive study has been prepared covering Belgium banking and financial methods and the nature and extent of Belgian foreign investments.

Acting Commercial Attaché Coldwell S. Johnston has been in charge at The Hague. About 50 special reports have been prepared and transmitted to the Bureau, as well as 150 answers to inquiries from private firms. Mr. Johnston left the service shortly after the close of the fiscal year.

Trade Commissioner Perry J. Stevenson took over the office at Johannesburg, South Africa, in August, 1920. During November he visited all the leading commercial centers of the Union. During the past year about 20 special reports have been prepared, particular attention being devoted to tariff legislation, the new Reserve Bank, electrification projects, and the automobile trade. Mr. Stevenson has cooperated closely with the newly organized American Chamber of Commerce in South Africa and has handled all commercial inquiries addressed to it by American firms. The adjustment of trade complaints has been an important function of the office; in one case a local firm was induced to take up a draft for £1,000. American manufacturers have been aided in entering into direct relations with South African suppliers of raw materials, including asbestos, chrome, and corundum, which are important in supplying return cargoes for vessels from the United States. During 1921–22 the work of the Johannesburg office will be extended to cover the adjacent markets of Portuguese East Africa and Rhodesia.

PERMANENT POSTS IN SOUTHERN AND CENTRAL EUROPE.

Commercial Attaché Charles H. Cunningham was transferred from Mexico City to Madrid in November, 1920, to relieve Trade Commissioner William A. Strachan, who was temporarily in charge of the Madrid office. Mr. Cunningham has made trips to Barcelona, Andalusia, and Portugal, while Mr. Strachan has studied conditions in Andalusia, northern Africa, Bilbao, and Santander, besides completing a study of Spanish laws governing foreign companies. American salesmen have been presented to Government offices; in one case an order for 50,000 tons of coal was secured for an American firm in this way. Much time has been given to the adjustment of claims and charges against American interests, especially the Shipping Board. Much market information has been furnished to visiting American salesmen, and American business has been extended through "trade opportunities." Hundreds of trade letters, representing individual research, were sent in reply to American inquiries.

Commercial Attaché Alfred P. Dennis, upon his transfer to London in October, 1920, was succeeded at Rome by H. C. MacLean, who was then promoted from trade commissioner to commercial attaché. Mr. MacLean has been assisted by Assistant Trade Commissioner Algernon A. Osborne. The attaché has made frequent visits to Milan and other industrial centers, including the new Italian territory in the Trentino. Besides securing from Italian Government offices information of tariff changes and modifications of export prohibitions, he was instrumental in obtaining favorable action on applications for export and import permits presented by American firms. He secured the removal of the former restrictions on the importation of American passenger automobiles. A special feature of the attaché's work has been the adjustment of disputes arising in the conduct of business between the two countries, and the settlement of several large claims against Italian importers was thus facilitated. Numerous opportunities for the extension of American trade have been pointed out. Maintaining close contact with the embassy, the commercial attaché has been able to conclude informally and expeditiously, with the various ministries, numerous questions referred to him. Mr. Osborne, during the past year, has specialized in answering specific inquiries from American firms and in the compilation of economic notes. He likewise prepared an exhaustive study on the Italian situation with regard to raw materials, besides covering the Trieste problem and other questions of timely interest.

The Berlin office of the Bureau was opened in July, 1920, by Howard W. Adams, formerly trade commissioner at Paris, with the title of "Representative of the United States Department of Commerce in Germany." Mr. Adams has worked in close cooperation

with the American Commission, and similar contact has been maintained with the American Military Mission and the Shipping Board representatives. Investigations have been carried out, covering, among other topics, the German optical industry, new German metallurgical processes, the shipping situation, the German sugar, automobile, and vegetable-fiber industries, and the local market for American export commodities. A large collection was made of German vegetable-fiber products which has since been exhibited in the Bureau's district offices. A similar collection of paper-yarn products was prepared. Mr. Adams has visited the fiber mills at Furstenberg (Mecklenburg), the Leipzig Fair, and metallurgical plants at Vilten and Rathenow (in connection with the optical industry). During the past fiscal year the Berlin office received 782 visitors. The efforts of the Berlin office in trade promotion have netted nearly $2,000,000 of concrete business, the largest portion of which covered credits for American cotton. Local agents have been secured for 18 American firms, and American interests have been aided in acquiring numerous valuable German patents. Import permits have also been secured for shippers of American goods into Germany.

The office of the Bureau at Prague has been directed during the past year by Trade Commissioner Vladimir A. Geringer, whose jurisdiction was extended to Hungary in October, 1920, when Assistant Trade Commissioner Donald L. Breed was associated with him. Mr. Geringer has handled all commercial and economic inquiries addressed to the legation. Special studies have been made of the automobile market and of the local production of graphite and newsprint paper. Mr. Geringer succeeded in expediting the rail shipment of unfinished fabrics made from American cotton to Austria for finishing, and enabled American firms to obtain large orders for typewriters, cotton, automobile accessories, foodstuffs, and other articles. The trade commissioner cooperated in surveys resulting in American investments in Czecho-Slovak cotton mills and facilitated the obtaining of Czecho-Slovak patents by American firms. He was able to secure adequate coal supplies for American-owned factories in his territory during the winter of 1920. Upon his arrival in Prague, Assistant Trade Commissioner Breed, aside from his work on routine reports, began the preparation of a commercial handbook on Hungary. In March, 1921, he opened a temporary office in Budapest for study of the situation in Hungary, where he remained until April 22 before returning to Prague.

Trade Commissioner William Ford Upson, who has been in charge of the Austrian office of the Bureau during 1920–21, has made investigation trips to the Tyrol, Salzburg, Steyr, and Styria. The office has been visited by more than 300 American business men; Ameri-

can representatives have been put in touch with Government officials and leading business houses, while agents have been located for American firms. The trade commissioner has been active in furthering the business of American packers and adjusting disputes arising therefrom. American automobile interests, studying the possibilities of an assembling plant at Vienna, have been assisted in their investigations. The office was instrumental in promoting the sale of large amounts of American leaf tobacco to the Austrian tobacco monopoly. Representatives of American cotton growers were furnished with data covering local sales, commercial methods, and bank guaranties. More than 200 inquiries and requests for information have been received by mail from American concerns, covering requests for trade lists, prospective agents, and adjustment of claims and trade difficulties. Time has been devoted to the compilation of a directory of leather users of Central Europe and the collection of a large number of samples of paper-cloth manufactures.

The Warsaw office has been in charge of Trade Commissioner Louis E. Van Norman, who has cooperated with all American diplomatic representatives in Poland and has established cordial relations with the Polish ministries. The trade commissioner was active in negotiations with the Polish Ministry of Finance regarding the remittance of relief funds from the United States to Poland. He endeavored to further sales of American raw materials for manufacture by Polish industry and, in this connection, to secure a mitigation of the mass of local regulations hampering Polish commerce. Mr. Van Norman was active in promoting the organization of a Polish-American Chamber of Commerce in Warsaw. He cooperated with American groups, endeavoring to arrange some form of credit guaranties based on Polish industries and natural resources, to cover American sales to Poland. He made investigation trips to Danzig, Lodz, Cracow, Lemberg, and Posen.

Trade Commissioner George Wythe was forced by ill health to leave Constantinople in December, 1920. His assistant trade commissioner, Julian Gillespie, took charge of the office for the remainder of the year. Mr. Gillespie made extensive reports as a result of his travels through Greece, Turkey, Syria, Palestine, and Egypt. He has continually assisted the American commissioner in the handling of commercial matters, and, while in Alexandria, Egypt, he was of material assistance, in a legal way, to the American consul in certain commercial negotiations. In May, 1921, Commercial Attaché Paul L. Edwards was assigned to Constantinople.

WORK OF ATTACHÉS IN LATIN AMERICA.

The offices in Latin America, like those in Europe and the Far East, have performed the functions common to all the permanent

posts, such as handling commercial matters for the embassies or legations, aiding visitors, and answering specific inquiries received from the United States.

Commercial Attaché Edward F. Feely, formerly at Mexico City, took charge at Buenos Aires in October, 1920; he has been assisted by Trade Commissioner George S. Brady. His office brought about the purchase of American motor trucks, and he put prospective Argentine buyers in touch with American locomotive manufacturers. Periodic trips have been made to Montevideo, Uruguay. Mr. Feely has been assisting the Argentine Minister of Foreign Affairs in planning a commercial-attaché service for the Republic. He has aided several American Government representatives, has cooperated with the American Chamber of Commerce and the American Drygoods Agents' Association, and has forwarded numerous reports to the Bureau.

The Rio de Janeiro office was in charge of Assistant Trade Commissioner R. M. Connell from June to November, 1920, of William E. Embry from November, 1920, to February, 1921, and, since that date, of Commercial Attaché W. L. Schurz, seconded by Assistant Trade Commissioners Bernard H. Noll and W. E. Embry. During a trying period every possible aid has been given to American interests in Brazil. During the tariff debates in the Brazilian Congress in 1920 the office was active in aiding American firms in the preparation of petitions in cases where the business of these firms was threatened by proposed changes in import schedules. A large number of valuable economic reports has been prepared, and among the investigations in progress are those on foreign competition, the Brazilian railways, the iron resources and metallurgical industry of Brazil, the finances of the Brazilian States, the market for motor vehicles, the trade between Brazil and Argentina, and the Brazilian rubber industry.

The office at Santiago, Chile, has been directed by Commercial Attaché Charles A. McQueen. In July, 1920, Mr. McQueen warned American exporters of impending difficulties and the desirability of filling pending orders as rapidly as possible. The subsequent cessation of nitrate sales, bringing with it a fall of Chilean exchange, caused many cancellations and failures, with the result that during the autumn the attaché's efforts were principally devoted to adjusting claims and facilitating the collection of disputed accounts. During the year about 400 American executives and salesmen called at his office. Chilean merchants have often called upon the attaché for help in connection with purchases from this country. During May and June, 1921, Mr. McQueen undertook a trip of investigation through the north of Chile.

From June to October, 1920, the Mexico office was directed by Trade Commissioner Charles H. Cunningham, aided by Trade Commissioner Bernard H. Noll. Mr. Cunningham adjusted a shipping dispute and obtained cars to move a large shipment of tallow belonging to an American concern. Upon his transfer to Madrid he was succeeded by Commercial Attaché Carlton Jackson; the latter, who had been trade commissioner at Lima, Peru, made a trip through the United States and arrived at Mexico City in December. Mr. Jackson has visited Vera Cruz and Guadalajara for the study of commercial and industrial conditions. The Mexico office now has in process of preparation a directory of local firms representing American manufacturers, exporters, and importers. On an average, 130 callers per month have been received, and about 75 reports, in all, have been forwarded to the Bureau. Many reports have also been prepared for private firms.

Acting Commercial Attaché Daniel Waters has been in charge at Lima, Peru. Investigations have been made covering markets for tractors, the foreign machinery sales, the use of automobiles, cotton statistics, advertising, wool pieces, and live stock, while studies have been made for questionnaires. Much time has been given to study of the port congestion at Callao, and conferences have been held with interested shipping agents. Mr. Waters has been active in promoting American participation in the Peruvian centenary exhibition of foreign products. Representatives of American pipe manufacturers have been placed in line to compete successfully for a large Peruvian construction contract. Twenty-nine trade disputes have been adjudicated by the office.

ACTIVITY AT PERMANENT POSTS IN FAR EAST.

The Peking office is directed by Commercial Attaché Julean Arnold, who has been assisted by Trade Commissioners Frank Rhea and Lynn W. Meekins, while Special Trade Commissioner J. Morgan Clements has been studying the mineral resources of China. Mr. Rhea has devoted most of his time to industrial and transportation problems with relation to investment opportunities, while Mr. Meekins, in addition to service in Peking, has made an extensive report on Manchuria and, during the latter part of the fiscal year, has directed the branch office at Shanghai. The Peking office contributed material favoring the China Trade Act that has been before Congress, and actively promoted the securing of Chinese radio-communication contracts by American interests. Opportunities have been secured for American manufacturers of railway equipment to supply materials for Chinese railways. This office maintains a motion-picture service, showing all over China several hundred American industrial and educational films. A branch office was

opened in Shanghai in January, 1921. A special investigation of import commodities and Chinese methods of handling import business is now under way. The American representative in China for the international consortium has had the assistance of the attaché and of Mr. Rhea. Personal service has been rendered to several thousand callers at the Chinese offices of the Bureau.

Commercial Attaché James F. Abbott was in charge of the Tokyo office during 1920–21. Trade Commissioner H. A. Butts arrived in September. The Tokyo office affords valuable aid to local American representatives by furnishing data on local conditions, introductions to Japanese customers, and assistance in adjustment of difficulties with Japanese official agencies. It has been active in adjusting trade disputes. Protests were entered regarding discrimination against American ships at Kobe and the causes for complaint were removed. During the past year special reports have been prepared on the silk situation, unemployment, the oil situation, coal resources, labor and wages, brushes, menthol, sugar of milk, the Japanese-German economic agreement, and the codfish industry. Mr. Abbott, in pursuing a special study of Japanese fuel problems, has made extensive trips to the Manchurian and Kyushu coal fields. On April 22, he left Tokyo on a special mission in Siberia. Mr. Butts has given special attention to the silk situation, with a view not only to keeping American business well informed of current developments, but of gathering material for a general study of the subject. He has thus made several trips to the Shinsu and other silk districts.

The office at Melbourne, Australia, has continued in charge of Trade Commissioner A. W. Ferrin, whose main work has consisted in making representations to the customs authorities, by which a number of changes in duties and regulations have been effected; in assisting in the adjudication of numerous disputes arising out of repudiation of drafts; in helping local importers of American goods to obtain means of remitting funds outside the banks; in obtaining permission for American firms to register for business under the war-precautions act; in facilitating transactions between American firms and government departments; in promoting American tenders on supplies for the new Morwell power scheme (several of which have been successful) and tenders on supplies for the Victorian Railways equipment branch; and in the preparation of numerous special reports on financial, mercantile, and industrial subjects. An especially important matter was the registration for business of two American insurance companies. Mr. Ferrin visited Queensland and Tasmania.

GENERAL ECONOMIC SURVEYS BY TRAVELING COMMISSIONERS.

Trade Commissioner H. Lawrence Groves was at Zurich, Switzerland, until January, 1921, when he was assigned to the Baltic States

of Esthonia, Latvia, Lithuania, and Finland, with headquarters in Riga. During the last six months of 1920 he submitted 56 special reports, prepared a commercial handbook of Switzerland, answered trade inquiries, adjusted claims, aroused interest in American goods, and took up the matter of direct representation of American firms. In the Baltic States he has traveled extensively and submitted regular reports, besides aiding American business men who have visited Riga and placing several of them in touch with purchasers.

Trade Commissioner Eliot G. Mears has been continuing work on an economic handbook of Greece, which will soon be completed.

Trade Commissioner P. L. Bell made a complete survey of the resources, industries, transportation, and commerce of Venezuela, as well as a report on the Dutch West Indies. Special attention was given to transportation, mining, agriculture, and cattle raising. Petroleum was made the subject of a special report. A careful analysis was made of the financial condition of the Venezuelan Government. Mr. Bell made a conference tour of 19 cities in the United States, making addresses and conferring with business men and organizations.

The Bureau has published the economic handbook of Paraguay by former Trade Commissioner (now Commercial Attaché) W. L. Schurz, and his handbook of Bolivia is now in print.

Trade Commissioner Frank R. Rutter, who made an investigation of industrial conditions in Japan during the past fiscal year, has been preparing an exhaustive handbook of the Empire, which will be completed within the next few months.

Trade Commissioner John A. Fowler, who has been in the East Indies more than two years, completed his survey of the Dutch East Indies in November, 1920, proceeding then to British Malaya. He has submitted hundreds of reports, on practically every aspect of economic conditions. He has gathered important data on the Singapore shipping situation, including material on the various shipping organizations. Much attention was given to the mineral-oil situation. In British Malaya, Mr. Fowler has systematically investigated tin production, especially at Salangor and Perak, as well as rubber and other important items. His principal achievement, aside from the steady development of his extensive survey, has lain in outlining the position of British and Dutch competition in shipping and in the mineral-oil situation and in defining the status of the various organizations at Batavia, Soerabaya, and Singapore.

After remaining at the attaché's office in Peking during July, 1920, Trade Commissioner C. C. Batchelder made investigations of conditions in Tientsin, Mukden, Harbin, and Vladivostok, and upon being ordered to India, while awaiting transportation in Japan during September, he studied the effect of the industrial depression upon

Japanese competition with American goods in India, besides reporting on the commercial museums in Tokyo, Nagoya, Kyoto, Osaka, and Singapore. After arrival at Calcutta in November, 1920, Mr. Batchelder reported extensively on local business conditions and methods, transportation facilities, and markets for American specialties. During January he visited the principal cities of Northern India (among them Benares, Allahabad, Gawnpore, Delhi, Amritsar, and Karachi) to determine their importance as distributing centers; he studied the local products available for export to the United States and, more especially, the articles of foreign origin sold in the bazaars. Material was gathered for a proposed handbook of India and a monograph on Indian markets for American goods. During February and March the same line of work was pursued at Jaipur, Ahmenabad, Baroda, Bombay, Madras, and Bengalore. In April Mr. Batchelder returned to Calcutta, and he spent May at Darjeeling in the preparation of reports.

COMMODITY INVESTIGATIONS.

During the two years that Trade Commissioner R. A. Lundquist spent in British South and Portuguese East Africa he prepared a technical monograph on electrical goods, secured data for a report on hardware, reported on the cooperative movement, and carried out general trade-promotive activities. He gave much time to the adjustment of postarmistice claims. Electric mining installations and problems connected with the proposed electrification of portions of the South African railways received his close attention. Mr. Lundquist subsequently proceeded to India to prepare a report on electrical goods. He returned to the United States in March, 1921, visited various cities for conferences with business men, and aided manufacturers and commercial houses interested in his former territory.

Trade Commissioner Walter H. Rastall completed his survey of the Asiatic markets for industrial machinery. He returned to the United States in June, 1921, for the purpose of preparing a complete report on the subject and establishing contact with interested persons. He devoted particular attention to the markets of the Dutch East Indies and British India, which are relatively little known.

Trade Commissioner Philip S. Smith has continued his investigation of markets for industrial supplies in South America. He has completed surveys of Argentina, Brazil, and Chile. It is expected that this investigation will be completed within the next fiscal year.

Trade Commissioner Henry F. Grady completed his investigation of financial conditions in the United Kingdom and was later assigned

to temporary duty in various European offices, after which he returned to the United States and was detailed to a division of the Bureau at Washington.

Trade Commissioner Norman Hertz completed his investigation of markets for leather goods in Europe, covering the United Kingdom, France, Belgium, and Scandinavia.

Trade Commissioner J. Morgan Clements finished his extended survey of mineral resources in the Far East and sailed for the United States in June. His reports will cover China and Japan.

Trade Commissioner George E. Hooker has continued his investigation of transportation in the United States.

Commercial Attaché Paul L. Edwards has been detailed during the greater part of the fiscal year to the Department of State, where he has served as secretary of the International Electrical Communications Conference. He completed this work in May and then sailed for his new post in Constantinople.

DISTRICT AND COOPERATIVE OFFICES.

Intimate, personal contact between the Bureau and the business men of the principal commercial centers is afforded mainly through the system of branch offices—the eight district offices maintained by Bureau funds at New York, Boston, Chicago, St. Louis, New Orleans, San Francisco, Seattle, and Manila, and the cooperative offices in 18 other cities supported financially by local organizations but provided with Bureau service.

The special importance of these offices arises from the fact that they are immediately accessible, so that when a local merchant or manufacturer is urgently in need of information with respect to foreign trade, he need only take down his telephone receiver to be supplied with data collected by trained Government investigators on the upper Yangtze River, in the fishing ports of Norway, or on the high Bolivian table-land. If he calls personally at the district office, he finds available for his use a vast amount of practical material in printed form, as well as the advice and assistance of commercial experts. That business men are alive to the value of such service is indicated by the 39,531 calls at seven of the district offices during the past fiscal year, and by expressions of appreciation such as this from a St. Louis electrical manufacturing firm:

> It is especially gratifying to know that this wealth of thoroughly reliable information is in such proximity that it can be obtained, one might say, at a moment's notice. We are very enthusiastic about the Bureau's St. Louis service.

The seven district offices in this country received 86,508 letters during the past fiscal year and wrote 51,528. They sent out 29,883 circular or form letters. They supplied "foreign trade opportunity" information and "trade lists" to the number of 226,803, sold about

$12,000 worth of Bureau publications, and obtained 900 new subscribers to Commerce Reports, the Bureau's commercial journal. Letters in the Bureau's files show that the furnishing of a single sheet of specific commercial data often leads to very large orders from abroad; and with that fact in mind one can readily understand the significance of the district-office activity that deals in such "trade helps" by hundreds of thousands.

While distribution and dissemination form the largest part of the work in these offices, the "gathering" activity functions simultaneously. The Bureau is daily in receipt of material from all parts of the world that requires local investigation in this country before it can be properly utilized. Much of this is highly confidential in character and plays an important rôle in the promotion of foreign trade.

INCREASED EFFECTIVENESS OF LATIN AMERICAN WORK.

The Latin American division of the Bureau has rendered notable service to American business men during the year just past. The work of the division consists in gathering, assimilating, and distributing commercial information concerning all that portion of the Western Hemisphere lying south of the United States. The main sources of information are the reports of the commercial attachés and trade commissioners of the Department of Commerce, those of the diplomatic and consular officers of the Department of State, and 182 periodicals pertaining to Latin America, together with catalogues, guides, maps, etc.

In case the division is not able to supply desired data from the material available in Washington, it sends instructions to Bureau representatives or questionnairies to consular officers, and in this way satisfactory answers can be obtained to questions of practically any character. The cable is used in communicating with Bureau representatives.

The information is distributed by publication in Commerce Reports and the press, by confidential circulars, by correspondence, and orally. The great amount of information distributed by correspondence is indicated by the fact that in the fiscal year 1921 the Latin American division sent out more than 7,000 letters answering inquiries. Each year a larger number of visitors call at the offices of the division, 520 being recorded in 1921.

The Latin American division conducts research covering a wide variety of subjects. If the research results in a report that seems to be of general interest, this is published in Commerce Reports in the form of a "Latin American circular." Twelve such circulars were published during the year, including "Inter-American cable facilities," "The petroleum industry of Mexico," "The petroleum industry and laws of Colombia," "Investment of Argentine capital since 1914," "Trade of the United States with Latin America in 1920,"

discussions of automobile markets in Central America, in Colombia and Venezuela, and in Mexico, and circulars on the lumber markets of Mexico, the West Indies, Central America, and other portions of Latin America.

The congestion at the port of Habana, Cuba, which developed in the early part of 1920 and grew rapidly worse during the spring and summer, led the Secretary of Commerce to appoint a committee representing the Government and transportation interests to visit Cuba to investigate and make recommendations. The Director of the Bureau and the chief of the Latin American division were members of this committee. There was cooperation with a Cuban committee appointed by President Menocal. After a two-weeks investigation the Cuban and American committees rendered to President Menocal a joint report, many of the provisions of which were later put into effect by Col. Desplaines, who was appointed special supervisor of the port. The work of the committee aided materially in the solution of the congestion problem.

Other Cuban matters that occasioned investigation and action were the embargo on the importation of rice, the proposed textile embargo, the financial crisis and the moratorium decree, and the work of the Sugar Finance Commission. The desire of the Western Union Telegraph Co. and the All-Americas Cable Co. to extend and improve their services in Latin America received considerable attention.

The International Congress of Merchants at Mexico City, the Mexican Good-Will Commission, the Peruvian Centenary Exposition (1921), and the Brazilian Centennial Exposition (1922) were among the trade-promoting projects to which attention was given.

The division attempted to settle, by friendly assistance, various trade disputes. It endeavored to aid American coal exporters by providing information as to the methods of entering the Latin American market. Among the other matters that engaged the attention of the division were the Salta-Antofagasta railway; the Finch-Boley plan for disposing of American goods congesting Latin American ports; the Tornquist proposal for establishing a "revolving credit" in favor of Argentina; the closing of certain Latin American branches of the National City Bank; the renewal of German competition; the methods of transferring money from Ecuador in spite of the fixed rate of exchange; and the participation by American firms in the Association of Nitrate Producers.

EXPANSION AND DEVELOPMENT OF FAR EASTERN WORK.

The work of furthering American commerce with the Orient, through the Far Eastern division, has progressed in a gratifying

manner during the past year. The service has been expanded and its value materially enhanced.

Among the innovations is a "follow-up" system by which the division keeps in touch with persons who have manifested interest in a particular subject and supplies them with pertinent data obtained by the Bureau. This feature has been greatly appreciated, and during the year 500 names were placed on the list of those desiring the service.

Weekly "reserve bulletins" (announced in Commerce Reports) have contained the gist of the 7,500 clippings made in the division during the year.

A method has been adopted of digesting the material in the division's collation files, as of January 1, 1921, and circulating the essential information in compact statements of four or five typewritten pages.

During the year there were added to the division's files 15,000 cards recording the receipt of information from Government representatives and 1,700 additional cards indexing books and pamphlets and magazine articles not clipped.

In response to written inquiries, the division prepared 6,349 letters, as compared with 5,901 during the fiscal year 1920, and this constitutes the most helpful and significant phase of its work. Nearly 400 verbal inquiries were attended to in the division.

About half of the Far Eastern division's staff is engaged in digesting and rewriting reports from consuls and Bureau field officers, so that they may be more readily used in Commerce Reports and by the press. These articles appear as "Economic and trade notes" in Commerce Reports, one day a week each being allotted to Japan, China, Australasia, and the Far Eastern Tropics (including India, Siam, Malaya, and the Dutch East Indies). These notes are widely copied and have proved very effective. The energies of the staff have been taxed in expanding and interpreting cable messages from the field and in handling the new monthly statistical service recently inaugurated, whereby statistics of American trade in 53 commodities with Far Eastern countries are prepared from the records of the Bureau's statistical division and, with appropriate interpretation, are published 20 days after the first of each month.

Revision of trade lists occupied a good deal of the division's time. Six hundred lists were issued during the year, and, of these, two-thirds were new.

The division has been concerned during the year, in one way or another, with most of the outstanding economic and social developments in the East.

Largely through the constructive cooperation of the American commercial attaché at Tokyo, acting on instructions from the Bureau, a great improvement was effected in the port conditions at Kobe, Japan, where developments had occurred very detrimental to the transshipment of American goods to the Orient.

An American company interested in developing the manufacture of cables wished to obtain information on the original sources of gutta-percha, and the trade commissioner at Singapore, at the suggestion of the Bureau, made an exhaustive study of the subject which tugal, Austria, Czechoslovakia, Hungary, Canada, and (because of was of substantial benefit to the industry.

The "China Trade Act of 1921" fostered by Representative L. C. Dyer, of Missouri, was perfected from a draft prepared in the solicitor's office of the Department as the result of conferences between the Far Eastern division and representatives of other Government departments interested. The bill passed the House of Representatives early in the first session of the Sixty-seventh Congress and is now under consideration in the Judiciary Committee of the Senate.

The Bureau has supported the movement to relax the immigration laws sufficiently to permit certain Chinese students to devote part of their time to actual experience in American shop practice, because of a realization that the most important factor in future sales of American machinery in China will be American-trained Chinese engineers.

WORK IN CONNECTION WITH EUROPE, CANADA, AND AFRICA.

The organization and methods of the European division are similar to those of the older Latin American and Far Eastern divisions. It gathers and disseminates data in much the same manner. It covers, however, a larger field than any of the other geographical divisions, its territory including the United Kingdom, France, Germany, Belgium, the Netherlands, Italy, Scandinavia, Spain, Portthe inclusion of certain colonies) practically all Africa.

Obviously, the division has to deal with many problems that are peculiarly perplexing by reason of the virtual disintegration of the prewar economic structure in certain sections of Europe. It has rendered notable service by watching the striking developments in European economic life and interpreting them for the benefit of American business. By presenting dependable data and drawing valid conclusions from them, it has enabled foreign traders utilizing its service to avoid numerous pitfalls and to proceed as prudently as possible.

Much assistance has been given through the medium of letters written in the division. For publication in Commerce Reports the

European division has prepared about 30 series of trade and economic notes and numerous longer articles.

PROMOTION OF COMMERCE WITH NEAR EAST.

On July 1, 1921, the Near Eastern division of the Bureau completed the first year of its independent existence (though it had acted practically as an autonomous unit since January, 1920). The countries and regions covered include Rumania, Bulgaria, Jugoslavia, Albania, Greece, Turkey, Smyrna, Mesopotamia, Palestine, Syria, Arabia, Persia, Afghanistan, Egypt, Abyssinia, Eritrea, Cyprus, the Dodecanese Islands, and the Maltese Islands.

The Near East has great potentialities, it deserves careful attention by firms in this country, and the work of the Bureau's Near Eastern division is correspondingly important. This work has increased in all directions. Inquiries for information, and the resulting correspondence, have been augmented by several hundred per cent. Various compilations have been published in Commerce Reports, articles have been prepared for trade periodicals, and material has been distributed through trade associations.

Much information concerning the Near East was disseminated through Commerce Reports. Considerable material appeared in the form of "Economic notes." In some cases it was simply announced that material was available, and then the whole report or its essential part was sent out on request. Certain reports were issued as confidential circulars.

Inquiries addressed to the division covered a wide field. Among the more significant matters were the oil question (in Rumania, Mesopotamia, Persia, Egypt, Palestine, and elsewhere), the shipping of Egyptian long-staple cotton, and purchases of currants from Greece. As a result of the division's efforts a classification of Greek currants for exportation to this country has been adopted by the Patras (Greece) consulate, and an improvement is expected in the quality of currants sold as food in the United States.

A good deal of information was given out regarding the general economic and financial condition of Rumania and its agricultural and industrial resources. Other matters that excited interest included concessions in various countries, the use of cables and alleged discrimination against American concerns, the exchange question, mineral resources, markets for motor vehicles and a great many other articles, ports and terminals, telephones, telegraphs, and railways, tractor trials, national debts, the mixed courts of Egypt, motion-picture films, etc.

There was close cooperation with the Chamber of Commerce of the United States and, after its formation, with the American sec-

tion of the American Chamber of Commerce for the Levant at Constantinople.

RESULTS ATTAINED BY RUSSIAN DIVISION.

The Russian division of the Bureau has naturally been handicapped in its activities by the disorganization and uncertainty prevailing throughout much of the territory with which it deals. Despite these disadvantages, however, something has been accomplished in this branch of the Bureau's work, and substantial aid has been given to American business men desiring to trade with those regions of the former Russian Empire where commercial transactions could safely be undertaken.

The division covers the former Russian Empire, which at present is divided into Russia (European Russia, Siberia, the Caucasian Republics, the Ukraine, Lithuania, Latvia, and Esthonia), Poland, and Finland.

A circularizing of American firms at the end of June, 1921, brought replies from nearly 1,800 concerns that declared themselves interested in the Russian field. During the past fiscal year the Russian division of the Bureau handled more than 2,700 letters, incoming and outgoing, many of which required a large amount of research work.

Nearly 4,000 reports and publications relating to this field were read, checked, commented on, or translated (if in Russian), and classified in such a manner that the fullest possible use might be made of them—by publication in Commerce Reports or the press, or by their preparation as special circulars. This work is rendered exceptionally difficult by the fact that no item of incoming information can be definitely accepted as reliable without first being subjected to a rigid process of verification.

Some of the articles prepared in the Russian division and published in Commerce Reports are: "Needs and resources of the Crimea," "The bristle industry of Russia," "Tungsten in Russia," "Possible developments in Russia's chemical industry and trade," "Furs and other raw materials," "Russian osmiridium and other platinum products," "Potential beet-sugar industry in Courland," "Latvian exports and imports," "Trade in Persian lambskins," and "Petroleum industry in prewar Russia."

The expert in charge of the division prepared a comprehensive report (practically a handbook) on the Baltic Provinces, the gateway to Russia; this has 128 pages and was published as Supplement No. 16c to Commerce Reports. A translation of a detailed account of the industries of Soviet Russia during 1920 was begun toward the end of the fiscal year. The list of publications on Russia in the English language was revised and enlarged. Various circulars were prepared and sent to the firms on the "Russian mailing list." Informa-

tion sent in by Bureau representatives in Poland and the Baltic Provinces was digested by the division and submitted, in appropriate form, to the American business community.

During the year the personnel of the division has consisted of only two persons, an expert and a stenographer, but arrangements have been made to increase the staff to meet the demands that will be made upon it during the coming year.

DIVISION OF STATISTICS.

The Bureau's division of statistics reports that the number of inquiries relating to commercial and other figures increased materially during the past year. The division furnishes all available statistics on each question submitted.

Congressional consideration of the new tariff bill resulted in many inquiries for statistics from business concerns and Members of Congress. Tables showing imports from and exports to 30 principal countries of agricultural products during the last 10 years were compiled for the Ways and Means Committee.

An advisory statistical committee, after an investigation of the methods of the Bureau of Customs Statistics, recommended that the procedure be changed so as to tabulate the reports for the Department of Commerce first, to be followed, after their completion, by the reports furnished to the collectors of each district. The new system began with the April reports. As a result it has been possible to furnish preliminary total values by the 9th and the reports of imports and exports by articles and countries by the 15th of the month.

Beginning with April, 1921, the Monthly Summary of Foreign Commerce has been issued in two parts. Part I, containing the main tables (imports and domestic exports by articles and principal countries), is issued around the 25th of the month following the one to which the figures pertain. Part II, containing total values by great groups, countries, and customs districts, foreign exports, merchandise in warehouse, commerce with noncontiguous territories, and other tables, is issued about 10 days later.

The publication of the quarterly imports for consumption was discontinued with the quarter ended December, 1920, on account of inadequate appropriations. The compilation of coal carried over 14 principal railways was also discontinued.

In view of approaching tariff revision, the annual statement of imports for consumption, published as Table 9 of Commerce and Navigation, was issued as a separate publication; through the efforts of congressional committees printing was rushed and it was ready for distribution on April 1.

Trade of the United States with the World in 1918 and 1919, showing imports and exports for each country by articles, was issued as

Miscellaneous Series No. 106. A similar monograph will be issued for 1920 and 1921.

A number of reviews of significant features in the foreign-trade statistics were prepared for Commerce Reports, including a study of quantity increases in exports as compared with values; relation of foreign exchange rates to import values; effect of decreasing wholesale prices in the United States on our foreign trade; trade of the Virgin Islands in 1918 and 1919; and our foreign trade in 1920 in the terminology of the Brussels international statistical classification.

The "special statistical service," inaugurated early in 1919, consists of furnishing to trade journals, commercial organizations, and business houses monthly statements showing, for certain articles, complete details of imports or exports by countries which it is not practicable to print in the Monthly Summary. This service has been accorded universal approval and the demand for its extension is much greater than the Bureau can supply.

The revised import and export classifications prepared by an interdepartmental committee were approved by the Secretaries of the Treasury and of Commerce in September, 1920. Instead of the former alphabetical listing, there is in the new schedules a classification of articles under 10 great groups according to origin or use, these groups being further subdivided on the decimal system according to component material and degree of manufacture. For exports 1,243 and for imports 974 separate classes are provided, instead of 700 each as in the present schedules. Quantities in customary commercial units or in weight are required for all classes, in addition to values. Because of the lack of the requisite appropriation, the new classifications have not been made effective yet. It is planned to apply the new system to imports when the permanent tariff bill is enacted, and to make it effective for exports as soon as additional funds, needed for handling the increased work under the extended classification and for improvement of the statistical service, are provided.

The plan for transferring the Bureau of Customs Statistics from the Treasury to the Commerce Department is dependent upon the decision of the Comptroller General of the United States regarding the power of the President to transfer the necessary appropriations or, if the Comptroller's decision is adverse, upon the enactment of a separate bill by Congress.

ORIGINAL RESEARCH AND COMPILATION OF FOREIGN STATISTICS.

The Bureau's research division has devoted the greater part of its time to answering individual inquiries with regard to the trade statistics of foreign countries. Numerous letters from business men indicate the great value of this service.

It has also worked on statistical tables giving imports and exports of the chief countries of the world and the share of the United States therein; these cover gold and silver and about 75 basic foodstuffs and industrial raw materials for 1908, 1913, and the three latest available years.

The division prepared, for publication in Commerce Reports, various statistical statements dealing with the trade of certain foreign countries in vegetable oils and vegetable-oil products.

During the latter part of the fiscal year, the forty-third annual number of the Statistical Abstract of the United States was issued.

A pamphlet entitled "Wholesale prices" had been issued annually since 1893, giving a record of weekly quotations. Copy for the 1920 pamphlet was prepared as usual, but its publication has been suspended because somewhat similar statistics are issued by the Bureau of Labor Statistics.

There are in the files of the division elaborate studies of world trade in various commodities, but they have not yet been printed because of lack of funds. Among these statistical compilations may be mentioned those on cotton goods, motor vehicles and bicycles, horse-drawn vehicles, agricultural implements and machinery, paper and manufactures of paper, electrical goods and machinery, and drugs, dyes, and chemicals. The preparation of these has involved much time and effort, and it is felt that provision should be made for adding the figures for the latest available year and publishing them for the use of the persons interested in these lines.

The research division has continued its work of bringing to the attention of American investment and development houses opportunities for foreign investment upon which reports have been submitted by American Government representatives abroad. It has also distributed to bankers special reports on fundamental economic and financial conditions in foreign countries.

DIVISION OF FOREIGN TARIFFS.

The fact that a new tariff measure has been in course of preparation in the American Congress has had a marked effect on the work of the Bureau's division of foreign tariffs. The division has prepared extensive compilations of rates of duty in foreign countries for the Committee on Ways and Means and for individual Senators and Representatives, among these being a statement of the rates of duty in 29 countries on all products included in the agricultural schedule of the United States tariff, with the rates converted into United States currency.

The publication in Commerce Reports of current notes on tariff changes was continued during the past year. It was deemed inadvisable, however, to publish any tariff monographs, because of the

tariff changes that are now in prospect in many foreign countries and the consequent impossibility of presenting data that would retain their accuracy for any considerable period. Moreover, the insufficient staff of the division would have made it impracticable, in any case, to undertake the translating and tabulating involved in such work.

The division has, as always, kept fully informed concerning tariff movements in foreign countries, and this task has been especially exacting because of the many tariff changes, resulting mainly from the economic dislocation that attended and followed the World War.

INCREASED ACTIVITY IN CORRESPONDENCE AND DISTRIBUTION WORK.

The correspondence of the Bureau registered a substantial increase over the preceding fiscal year. There were about 150,000 incoming letters, while the total outgoing correspondence (comprising general answers to inquiries and not including mimeographed communications) approximated 115,000 pieces. More than half of the outgoing correspondence originated and was prepared in the correspondence section of the division of correspondence and distribution. The division answered a very great variety of trade inquiries.

This division includes, also, the distribution section, which sends out Bureau publications, circulars, and trade lists, and the commercial-intelligence section, which maintains a World Trade Directory of business houses and prospective buyers and agents. About 17,000 new reports on foreign firms were received for this directory during the past fiscal year. The commercial-intelligence section prepared 831 separate commodity trade lists, showing the character of business conducted by all the firms named and "starred," in most instances, to indicate their relative size. More than 500,000 copies of such lists were distributed to American business men during the year. This service is growing in popularity and importance.

EDITORIAL DIVISION.

The editorial division handled, as usual, a very large number of reports. The commercial attachés and trade commissioners, representing the Bureau in foreign countries, sent in 4,962 reports during the year, an increase of 1,482 over the previous fiscal year. On the other hand, the number of registered consular reports decreased from 22,610 in 1920 to 19,825 in 1921; the discontinuance, in the fall of 1920, of the practice of numbering trade letters accounts for most of this difference. A decrease of 40 per cent took place in the Foreign Trade Opportunities, the number in 1921 being 1,926 as compared with 3,364 in 1920.

Material edited in the division during the year amounted to approximately 11,600 printed pages. Eleven monographs were prepared for publication in the Special Agents Series, 61 in the Industrial Standards Series, 3 in the Miscellaneous Series, and 1 in the Special Consular Series. During the year there were 6,592 pages in the daily Commerce Reports and 1,219 pages in the Supplements, the latter containing the annual reports of American consular officers.

The publication of the Supplements was discontinued at the end of the year 1920, principally as a measure of economy, by reason of the shortage in the printing appropriation. Since that time the more significant of the annual reviews have been published, in condensed form, in Commerce Reports itself.

A new feature in Commerce Reports that has been well received by the business community is the "Monthly cable service," comprising strictly up-to-date information cabled to the Bureau by the commercial attachés and trade commissioners throughout the world.

At the end of the fiscal year, steps were being taken to publish Commerce Reports weekly, instead of daily. This important change went into effect September 6. The size and make-up were greatly altered. The various articles are now grouped under commodity headings, such as "Textiles," "Chemicals," "Machinery," etc. In the past, there has been no definite classification of articles. The new Commerce Reports have at least 64 pages each week.

RECOMMENDATIONS.

The Bureau requires great additional strength if it is to serve the purpose really intended by Congress and meet the demands that are made upon it by the business men of the country in their present distress. Not only should more attention be given to trade promotion, with which the Bureau has been almost exclusively concerned in the past, but it should be possible to make the more detailed economic surveys abroad that are now so indispensable because of the enormous financial interest we have in foreign fields. There never has been a time in the past, and perhaps may never be in the future, when accurate economic data on the situation in foreign countries was so vital to our material well-being.

Before the close of the fiscal year under review Congress provided funds for the establishment of commodity divisions in the Bureau, and shortly after the beginning of the new year a sufficient number of high-class men were found to organize some 12 or 14 such divisions. These divisions will not only organize and direct the collection of information abroad concerning their commodities (such as textiles, coal, machinery, etc.), but will set up, with the active help

of the industries themselves, the machinery for the best possible distribution of such information. These divisions are revolutionizing the methods of the Bureau and should be considered a long and important step in the right direction. Next year another long step should be taken and money should be forthcoming to expand the work along logical lines.

Congress has also very wisely provided a new technical division to handle the difficult subject of foreign commercial laws. The unit was in operation shortly after July 1, 1921. The Bureau should have more technical divisions of this sort to provide really expert advice on such subjects as foreign credits, packing, and transportation.

The regional, or geographic, divisions are in process of reorganization, but this reorganization will of necessity fall short of what is needed because of the inadequate funds available for the work. The new commodity divisions will not displace the regional divisions, which must continue to be relied upon for the surveys of general economic conditions in foreign countries.

With improved prospects for adequately staffing the Washington office, the necessity for keying up the foreign staff to the point where it can keep pace with the demand from the directing force of experts at home is at once apparent. The service of the Bureau as a whole can not be better than the weaker of its two branches, whether it be the home office or the foreign service.

Appendix D.—ABSTRACT OF REPORT OF THE DIRECTOR OF THE BUREAU OF STANDARDS.

(S. W. STRATTON, *Director.*)

The National Bureau of Standards is engaged in industrial research and standardization. The work is grouped under standards of quality for materials, standards of performance for devices, and standards of practice for utilities, scientifically based upon standards of measurement, and upon standard numerical constants or measured data concerning the properties of material and energy. This is an epoch of standardization when standards are being set systematically in all lines of activity to promote efficiency and minimize waste. The simplification of staple grades and sizes of articles of commerce facilitates quantity production, interchangeability, and repair, and promotes economy and efficient utilization generally.

The Bureau's work is conducted by a staff of 850 employees, housed in 13 laboratory buildings, a technical library of nearly 22,000 volumes, and a range of subject and variety of equipment unique in research laboratories. The research results are made available to the industries through the Bureau's publications (of which nearly 800 have been issued). During the year the Bureau issued 86 new publications, comprising 33 scientific papers, 27 technologic papers, 18 circulars, 3 handbooks, and 5 miscellaneous publications. A technical news bulletin, issued each month, describes current investigations in progress and results obtained in the laboratories.

WEIGHTS AND MEASURES.

In connection with length measurements the past year has been a busy one, as this section has spent a great deal of time in overhauling its apparatus and in making some intercomparisons of its standards, doing this work with the highest possible accuracy. In precision length measurements, micrometer microscopes are very largely employed, and because of their importance in this work one member of the section has spent a great deal of time in investigating the performance of such instruments. The routine testing of the length section has been systematized to such an extent that it occupies but a small fraction of the time formerly necessary for such work, thus allowing more time to be put on fundamental research.

Over 6,000 weights were tested by the mass section during the year. These weights were mostly high grade and intended for use in chemical and physical laboratories. The percentage of rejections among these weights is still quite high, and as one bad weight in a set means that the entire set must be rejected, this has resulted in a great deal of delay in supplying weights to those who require certified weights in their work. Some method of avoiding this difficulty should be worked out. Some valuable aid has been furnished the Motor Transport Corps in connection with the weighing of parts of the transmission of motor trucks to determine the amount of wear. Another extended research, completed during the year, is that concerned with the absorption of moisture by celluloid. Considerable time has been devoted to overhauling some of the high-precision balances, and the apparatus of the section is now in very good condition.

The construction of stop watches has been thoroughly investigated, since many of the watches of this type supplied to the Bureau for its work have proved unsatisfactory. It would appear that a great many commercial stop watches are of poor design and construction, and the Bureau hopes to be able to aid the industry in developing a better type. Aid was rendered by the Bureau to the horological industry of the country through a conference under the auspices of the National Research Council, at which the Bureau was represented.

The usual large amount of chemical and other volumetric glassware was tested during the year, this work showing an increase of 47 per cent over the fiscal year 1920. The percentage of glassware which passed test was somewhat higher than last year. American firms are planning to place on the market volumetric ware of the highest class, which will be of great benefit to the chemical industry.

In the Southwest, where natural gas is largely employed, the correct functioning of the meters by means of which the supply of gas to towns is measured is of great importance. The Bureau has recently been called upon to test a number of these meters and to settle disputes arising between the gas companies and the municipal governments, as well as between the companies and the consumers. The work has shown that by paying more careful attention to the stopping of leaks in the gas mains several million dollars could be saved each year.

The measurement of the thermal expansion of solids requires very careful work and elaborate apparatus. The total changes of length are usually extremely small, and for that reason must be determined with great accuracy. Important work along these lines has included the study of so-called fish scaling of enameled metal ware, a defect which has caused the manufacturers of this class of articles a large annual loss. The trouble has now been proven to be due to the difference in thermal expansion between the metal and the enamel.

Among the most important work in connection with weights and measures which the Bureau carries on is the testing of railroad track and mine scales. For this work it has specially equipped cars and motor trucks, which are sent to all parts of the country where such scales are employed. During the past year a great deal of time and attention had to be given to overhauling the Bureau's track-scale test cars, which have been in almost constant service for a number of years. This has necessitated a modification of the program of testing the master track scales of the railroads, which according to an agreement with the Bureau are to be tested once each year. It is hoped that during the coming year, repairs to the cars having already been taken care of, the old schedule can be adhered to.

In this connection the necessity for a central depot to house the Bureau's master track scale must be again emphasized. Although the scale has been completed for several years, lack of funds has prevented its installation. The need for such a central depot is urgent, and some provision should be made at once for a suitable building.

The testing of precision gages of all sorts has been continued, the number examined this year being slightly greater than those sent to the Bureau during the fiscal year 1920. A less number of gages were submitted by the Government, but this was more than made up by the larger number sent in by manufacturing concerns. This would seem to indicate that makers of machinery in this country are coming to realize the importance of accurate fits in their work, particularly where the parts are intended for interchange. The special work carried on during the year has included the testing of gears and gear cutters, and a certain amount of preliminary work in the development of a standard system of finger-ring sizes, and also in the standardization of buttons.

As in the past, the Bureau has cooperated in the closest possible way with other bureaus and departments of the National Government and with the State governments in weights and measures laws and administration. The Fourteenth Annual Conference on Weights and Measures was held at the Bureau on May 23–26, 1921, and was attended by officials from 27 States and the District of Columbia besides municipal weights and measures officers and representatives of manufacturing plants. Many problems of the first importance, such as the sale of bread by weight and the establishment of proper tolerances for weighing and measuring devices, were discussed, and it was the consensus of opinion of those present that the conference was the most successful thus far held. The compilation of the weights and measures laws of the various States has been continued

during the year, and the work is now finished, but has not been printed, owing to a shortage of funds.

The Bureau holds memberships on many important committees, such as the National Screw Thread Commission, the American Society of Mechanical Engineers' Sectional Committee on Unification and Standardization of Screw Threads, and the Committee on Plain Limit Gages for General Engineering Work. It has done important work in connection with the problems before these committees and the Progress Report of the National Screw Thread Commission, which was issued during the year, is a notable step forward in the standardization of screw threads.

ELECTRICITY.

The Bureau's work in electricity is concerned with the fundamental investigations of electrical standards, from which the standards used by manufacturers of electrical apparatus throughout the country are derived, with the testing of electrical instruments and devices, with the development of improved appliances, and with the preparation of safety codes governing electrical construction. Since some classes of service furnished by public-service corporations are similar in a general way to electrical service, work is also done in the fields of gas engineering, central heating, and in connection with general safety work. The field of electrical communication is also completely covered, and the application of electricity to precise measurements forms an important part of the work.

In connection with the testing of standards of resistance, the demand for such work has been greater than at any time in the history of the Bureau, but in spite of the large amount of routine work thus required, some important fundamental work on the comparison of international resistance standards has been carried out. The resistance of the human body has been studied, and various refinements have been developed for use when making resistance measurements. A suggestion has been made that the present system of international electrical units be discontinued, and that measurements of electricity be expressed in units to be a part of the c. g. s. system. In this connection careful study has been given to the unit of resistance to be used. Another investigation has had for its object the placing of the expression of the conducting power of a conductor on the same logical basis as other electrical units. Good progress has been made in this work.

Since a great many tests of inductance and capacity can only be made in the Bureau's laboratory (there being no other suitably equipped institution in this country), a great deal of time has to be devoted to this work. This has limited the amount of research work to a few fundamental investigations. A study has been made

of the inductance and resistance of parallel rods, and a set of observations covering several years have been made on some air condensers to learn if possible the causes for changes in capacitance.

In cooperation with the Navy Department, the important work in connection with ballistics and allied problems has been continued. This has included a study of the variation of gun pressure with time, the time occupied in primer explosions, a study of ejection velocities and firing-time intervals, the development of interior ballistic formulas, an investigation of the pressure in recoil cylinders, the measurement of the velocity of projectiles inside the bore of the gun, and the photographing of projectiles in flight. Some interesting measurements were made at the firing trials of the Brazilian battleship *Sao Paulo*, and a report rendered to the Navy Department. Important work along similar lines has been done on the U. S. S. *Tennessee*, and measurements of gun-turret movements during firing will be made at the time of the trials of the new U. S. S. *California*. A study of the physical constants of submarine mines has also been completed.

In cooperation with the automotive power plants section of the heat division, work has been continued on the measurement of the electrical characteristics of gasoline-engine ignition systems. Through representation on various committees assistance has been rendered on a number of electrical problems, and some research work has been undertaken for manufacturers, as a result of visits to their plants, where the needs of the industry were studied. Improvements have been made in the apparatus for the measurement of high voltages, work which is of great importance in connection with long-distance power transmission.

Experiments have been carried out on magnetic measurement of very short specimens, work which is important where only a limited amount of material is available. The magnetic analysis of steel is now regarded as a most important way of testing this material, and the Bureau is going into the subject very thoroughly. By this means it is possible to easily determine whether there are flaws in the steel without destroying it, which results in a large saving of material. Some of this work is in cooperation with a special committee of the American Society for Testing Materials. Some work has been done on the development of a special type of magnetic compass for use on fighting tanks.

Some progress has been made during the year on problems in light measurement. International agreement as to methods for the comparison of lights of different color is highly desirable, and at a meeting of the International Commission on Illumination held in Paris in June, 1921, the Bureau presented a report on the status of heterochromatic photometry. A report on primary standards of

light was also submitted. The growing use of gas-filled and other incandescent lamps with coiled filaments has made the use of an integrating sphere practically indispensable, and to meet the need for information on this subject a paper is being prepared and will be ready during the coming year. Several improved types of reflectometers have been constructed, one of which is described in Scientific Paper No. 405. A ninth edition of Circular No. 13, Specifications for Incandescent Electric Lamps, is being prepared. This revision of the specifications has been made necessary by the growing use of tungsten and gas-filled lamps. The new specifications, which have been adopted for the fiscal year beginning July 1, 1921, are modified in respect to the life tests of tungsten lamps.

As a considerable portion of the work in radio communication is carried on at the request of other Government bureaus, the funds being provided by these organizations, the research work is quite largely determined by the needs of these branches of the Government. The Signal Corps, Air Service, and Bureau of Markets of the Department of Agriculture have presented to the Bureau a large number of problems for solution during the year. Considerable attention has been paid to keeping the reference files on radio subjects up to date, and the library which is thus being collected is becoming increasingly useful each year. Along with this work, progress is being made in the standardization of radio terminology, a subject in which the Bureau is cooperating with the Standardization Committee of the Institute of Radio Engineers, and a member of the Bureau's staff has been appointed secretary of the American branch of the International Union of Scientific Radio Telegraphy. Conferences have been held with the Coast Guard Service on the possible utility of radiotelephony for lifeboats. In cooperation with the Signal Corps, a special direction finder has been developed for use on motor tractors, which will allow one of these machines to locate its position on land by reference to signals sent out from definite stations in the same way that vessels can now do on the water. Improvements have been carried out during the year on the radio fog-signaling apparatus at the radio beacon stations on Fire Island Lightship, Ambrose Channel Lightship, and Sea Girt Lighthouse. Successful demonstration tests of the direction-finding apparatus were made, using the installation on the lighthouse tender *Tulip*. An increasing amount of interest is being shown in simple radio receiving apparatus, suitable for use in connection with the market reports now being sent out. The Bureau is compiling information respecting such sets. Assistance was rendered the Bureau of Markets of the Department of Agriculture in the broadcasting of the market reports just mentioned. This service was carried on for some time by the radio station of the Bureau of Standards, but has

now been turned over to the Air Mail Service of the Post Office Department.

The damage caused by electrolysis of underground pipes in our cities is very great, and has resulted in many disputes between traction companies and the owners of the pipes. The danger and loss is not alone due to the injury to the pipes themselves, but to the indirect loss, caused by the weakening and bursting of water mains at critical times, the leakage of gas from pitted mains, etc. The Bureau has for some time made surveys of electrolysis conditions in our cities, and has often been able to point out ways for lessening the damage and dangers arising from this cause. The investigation of lead cable troubles in St. Louis was completed during the year. It was pointed out that there were in all five separate causes of the electrolysis of these cables, and their relative importance was indicated. The Bureau is cooperating with all the great national associations interested in the electrolysis problem, and it is hoped that the work can be pushed more vigorously during the coming year. Considerable improvement has been made in the apparatus used in making field surveys and some entirely new methods have been worked out.

HEAT AND THERMOMETRY.

The number of clinical thermometers tested during the year, 26,336, is slightly larger than last year. The interesting fact in connection with this work is that over 95 per cent of these thermometers were for veterinary use. Progress is being made in the elimination of misleading certificates in the clinical thermometer field, but there is room for much further improvement in this direction.

More interest is being shown each year in pyrometric work on account of the rapidly increasing importance of the measurement and control of high temperatures in many industrial processes. The recent publication on pyrometric practice (Technologic Paper No. 170) issued by the Bureau has been received with enthusiasm by the industries and by technical educational institutions.

Work has continued on the determination of the fundamental constants of refrigerating engineering, and a report covering the investigations to date was made at the December meeting of the American Society of Refrigerating Engineers. The completion of the tables on the properties of anhydrous ammonia will require experimental data on the specific volumes and specific heat of the saturated vapor. The necessary apparatus has been constructed and preliminary measurements made. A new flow calorimeter for work in connection with the determination of the specific heat of gases has been completed, and a paper is to be published in the near future on

new forms for the Mollier chart as used in refrigerating engineering. Investigations have been made of very small pressure relief devices, and valuable data have ben secured on the diaphragms used with such appliances.

Work on the fire resistance of building materials has been actively pushed during the year. The technologic paper on the fire tests of concrete columns is now being prepared for publication. An extensive program of tests of brick walls, made up into panels 11 by 16 feet in size, has been laid out and the experiments are well under way. Both 8 and 12 inch walls are to be tested under fire conditions and their effectiveness as fire barriers determined. In cooperation with the Hollow Building Tile Association an investigation has been commenced on the fire resistance under load of hollow tile. A room is being equipped for special work on ignition points of various substances, spontaneous ignition, etc.

Unusual interest has been shown in some parts of the Bureau's work in connection with automotive power plants. In the altitude laboratory two major investigations have been carried out, one being the altitude testing of airplane engines in cooperation with the Engineering Division of the Air Service of the Army, and the other the effect of compression ratio on the performance of aviation engines. Two representative German engines have been tested. Results of considerable value on the relation of compression ratio to engine performance have been secured. Eleven reports on these subjects are in process of preparation. In cooperation with the electrical division, work on ignition systems has been continued. This has included the investigation of spark plugs and porcelains, a study of the effect of the electrical character of the spark on ignition, and an investigation of the mathematical theory of induced voltage in high-tension magnetos. A study is being made of the deterioration of lubrication oils after long service in a typical automobile engine, and oils for special purposes have been investigated. Two main problems have been studied in connection with carburetors; the mixture control for aircraft engines and the distribution of liquid and vaporized fuel in the intake manifold. The fuel economy of six widely used types of automobile carburetors has been investigated for different loads and speeds. In order to understand more fully the phenomena of combustion in the cylinders of internal-combustion engines, experimental studies have been made of the rates at which various air-fuel mixtures burn under different conditions. A special one-cylinder engine has been used for some of this work. A systematic compilation and revision of all research results obtained during the Bureau's investigations in connection with radiators for aircraft engines has been made, and a comprehensive report will be issued on the subject.

At the request of the Motor Transport Division of the Quartermaster Corps of the Army, a special investigation is being made of the performance of motor truck rear axle assemblies. This work includes a determination of the efficiency of power transmission under all conditions of load and an endurance run to bring out any possible weakness in the construction. An important investigation of the properties of brake lining materials for automobiles has been in progress during the year. Many samples have been sent in by manufacturers and a conference was held at the Bureau at which most of the parties interested were represented. Data which will lead to standardization of tests of brake lining materials are being secured.

OPTICS.

The year has witnessed the completion of some very important work in the field of optics. In connection with spectroscopy accurate wave-length measurements of the spectra of the inert gases, helium, neon, argon, krypton, and xenon have been completed. The peculiar characteristics of the spectra of these gases make them particularly useful as standards for length measurements. In cooperation with the Bureau of the Mint of the Treasury Department an elaborate study of the spectra of various alloys of gold has been carried on. This work has yielded very satisfactory results and may revolutionize the methods of gold analysis in use by the United States Mint. About 100 tubes filled with various gases have been prepared in the Bureau's laboratories for the use of educational and research institutions throughout the country in connection with spectroscopic research. The work on the hypersensitizing of photographic plates, which renders them sensitive to the longer wave lengths of the spectrum, has been continued with satisfactory results and has had an important bearing in recent improvements in photography of various kinds, including the taking of pictures from airplanes through haze and fog.

The work of the sugar section has been prosecuted with vigor, and in spite of the necessary curtailment along certain lines important results have been accomplished. Laboratory and semicommercial-sized sugar-refining equipment has been obtained, often by loan from the manufacturers, so that it is now possible to study new processes of refining sugar on practically a commercial scale before the method is given to the manufacturers, thus avoiding delays and errors which are very costly in a commercial plant. Through the researches of the Bureau, American manufacturers are now able to produce a number of the rare sugars, which are extremely important in pathological researches, in quantities and at prices comparable

with those existing before the war when Germany was practically the only source of these materials.

The causes of strains in optical glass and the proper methods to be used in annealing glass have been studied, and after a long investigation important preliminary work has been completed on the establishment of a standard for "white light" which really forms the whole basis of colorimetry. Valuable data on the color and spectral transmissivity of vegetable oils have been collected, and standards for the color grading of numerous commodities have been established.

In cooperation with the Ordnance Department of the Army, a very thorough investigation of short base line range finders has been completed. The work included over 21,000 observations by different men in the service in order to insure good average results.

Several improved optical instruments have been designed and in some cases constructed by the Bureau's shops during the year. These have included a small laboratory telescope, a high-precision refractometer, and a universal polarimeter. Successful methods have been devised for testing eye-protective glasses, used in guarding the eyes of workmen from injurious radiations, and a very simple means has been worked out for coating the windows of buildings in such a way as to keep out the ultra-violet solar radiations, which are destructive to certain materials.

In connection with a study of the turbidity of water supplies, a report was read before a meeting of the American Water Works Association.

The use of interferometric methods in the exact measurement of standards of length has been continued, and is now applied with great success to the comparison of precision gages and similar appliances used in the industries. Standardized methods are being developed for measuring the properties of photographic materials, and a new and improved form of sensitometer has been developed. Since the patent covering this device has been dedicated to the public, anyone desiring to use apparatus is at liberty to do so.

CHEMISTRY.

This division cooperates with every other division of the Bureau, for there is hardly an investigation which does not involve a chemical analysis of some sort. Chemistry, likewise, enters into the preparation of almost every specification for technical supplies, and for this reason the chemistry division is often called upon to assist other bureaus and departments of the Government.

During the year valuable assistance has been given to the Bureau of Engraving and Printing in connection with the production of engraved printing plates by electrolytic methods. This process was developed in the Bureau's laboratories and has been placed on a suc-

cessful commercial basis. In the past months several ways for improving the process and for securing added economies have been discovered. As a result of the information gained through the operation of the above plant the Bureau is attempting to adapt the methods to other electrotyping operations, and with the assistance of a commercial concern some progress has been made. In cooperation with the Navy Department a study is being made of the factors which control the deposition of lead and tin in commercial electroplating processes. There is a very large field for investigational work of this sort, and the Bureau has received the hearty support of such organizations as the American Electroplaters' Society, the International Association of Electrotypers, and the American Electrochemical Society. It is hoped that with some additional funds secured through the efforts of the National Research Council the work can be pushed during the coming year.

In connection with the air services of both the Army and the Navy a great many samples of balloon fabrics have been tested for their physical properties and for permeability. A report was issued detailing the results of this work. Work has been continued on the development of apparatus for automatically recording the analysis of gases, using the thermal-conductivity method. A large number of these instruments have been constructed and installed at Government gas-production plants. The performance in some cases has not been entirely satisfactory, but on the whole the installations have proved well worth while and valuable experience has been secured as to ways of improving the mechanical details. The investigation on different ways of producing hydrogen for Government use was started about a year ago and has yielded some valuable results, two practicable methods for producing hydrogen at a cost less than is now the case having been developed. At the request of the Bureau of Engineering of the Navy Department, an airship slide rule, useful in connection with calculations of the lifting power, etc., of lighter-than-air craft, was designed and constructed. An order was immediately placed by the Air Service for a large number of these rules. A good start has been made on a bibliography of the scientific literature relating to the properties of gases, but the work had to be discontinued owing to lack of funds.

Research on the chemical and physical properties of the platinum metals has been continued. Considerable quantities of very pure metals of this group have been produced. This includes 1,100 grams of platinum of a higher degree of purity than any which the Bureau has been able to obtain from manufacturers, either in this country or abroad. A number of thermocouple alloys have been analyzed for the heat division. In connection with this work, it may be of interest to note that of the platinum stolen from the Bureau during

March, 1920, about 80 per cent was recovered in March of this year. Assistance was rendered the Department of Justice in its investigation of the theft of platinum from the Old Hickory Powder Plant. near Nashville, Tenn.

Standard samples of metals and alloys were distributed as in former years, but unfortunately the small fund of $5,000 for this work was entirely cut off, which made necessary the curtailment of the distribution. Nevertheless, in spite of this difficulty, the Bureau was able to supply 4,016 of these samples to American industries. When it is remembered that these samples form the fundamental chemical standards for the manufacturers of this country, the importance of the work will be appreciated. The fund formerly provided for this work should be restored and increased if possible. It should be borne in mind that this results in no expense to the Government, the fees received for the samples more than equaling the amount of the appropriation. Some cooperative work was performed on British chemical standards, the Bureau acting in connection with British, Scotch, French, and Italian analysts. A study of the Jones reductor with special reference to the reduction of iron, titanium, chromium, molybdenum, vanadium, and uranium has been partially completed.

The usual large number of routine tests on all sorts of materials, such as balloon fabrics, rubber goods, textiles, inks, carbon paper, typewriter ribbons, glue and paste, etc., have been conducted for Government departments and the General Supply Committee.

Active work by the Interdepartmental Committee on Paint Specification Standardization, on which the Bureau is represented, has been continued this year, and a sufficient number of specifications have been issued to be of decided use in the industry. Many of the specifications are being employed by persons outside the Government and some have been adopted as standard by the American Society for Testing Materials.

ENGINEERING PHYSICS.

A wide variety of work, including investigations relating to mechanics, sound, and properties of matter, testing and investigation of engineering instruments and mechanical appliances, studies of sound ranging and the soundproofness of building materials, studies of acoustics, investigation and testing of aircraft instruments, and work in aerodynamics, is included under the above title.

The Bureau is one of the few laboratories in the country equipped with a tank in which current meters can be rated, used for measuring the flow of water in rivers and other open channels. As this tank is completely housed in, it can be used at all seasons, and has been used for a great number of tests during the past year. In all, 511

instruments have been tested, including besides current meters, pressure gages, steam-engine indicators, anemometers, ordinary water meters, speedometers, etc. A more reliable form of safety valve for hydrogen cylinders has been developed, which will give the desired degree of safety but will not waste the gas. The investigation of radiator return line valves, for the office of the Supervising Architect of the Treasury Department, has been continued. The use of improved valves in this work will result in a large saving of steam, and a consequent reduction in the amount of fuel burned in the public buildings coming under the control of that office. In cooperation with the Vacuum Cleaners Manufacturers' Association, a standard procedure for testing vacuum cleaners is being developed, which will reduce the ratings on all types of machines to a comparable basis. A number of different makes of fire extinguishers have been tested, as in the past, for the Steamboat-Inspection Service.

Owing to the lack of suitable measuring instruments investigators have been greatly hampered in making sound investigations. Therefore, the Bureau has devoted considerable time to the improvement of existing and the development of new sound-measuring devices. A portable electromechanical sound source has been devised which can be used under difficult conditions. An apparatus which can be used for measuring sounds of different frequencies has also been constructed, being a development of the machine devised by Prof. G. W. Pierce. The two devices just mentioned have been used to study the sound field of a large parabolic mirror used by the Army for locating hostile air craft. Work has also been done on a method for locating enemy airplanes by means of the heat radiated from their engines.

Many requests have been received to study the acoustical defects of buildings and assembly halls with a view to suggesting remedies for these unsatisfactory conditions. The Bureau has only been able to give a limited amount of assistance in these cases, as the work in most cases involves an extended investigation. However, some valuable aid has been given. An electron-tube drive for tuning forks, developed last year, has been considerably improved, and a successful radio time recorder has been designed and constructed for the Coast and Geodetic Survey. In cooperation with the Ordnance Department of the Army a chronograph has been developed for very precise measurement of projectile speeds over small distances. Paralleling this work, the feasibility of utilizing the piezoelectric effect for obtaining a graphical record of the time-pressure relation in the discharge of a gun has been investigated. What appears to be a satisfactory apparatus has been developed. Various phases of sound ranging have been studied in cooperation with the Signal Corps and the Ordnance Department. This work has made

necessary the designing of several new instruments, including a string galvanometer and an oscillograph without damping fluid.

For some time an extensive program of research and development work has been under way on aeronautic instruments in cooperation with the Army, Navy, the National Advisory Committee for Aeronautics, and with other Government agencies and some private firms. Besides investigational work, a good many routine tests of aircraft instruments have likewise been carried out. A thorough study has been made of the effect of altitude on air-speed indicators, a special wind tunnel of small size designed for studying the performance of instruments at high altitudes having been set up in one of the Bureau's altitude chambers for the purpose. Research leading to improved methods for making instrument diaphragms has been continued, and a study has been made of the hysteresis effects in Bourdon tubes, such as are used in many pressure gages. Bimetallic bars, used to operate temperature compensating mechanisms, aircraft sextants, and compasses and turn indicators have likewise been studied. A number of improved types of instruments have been designed and built during the year, such as a precision barometer, temperature-compensated altimeter, precision barograph, recording rate-of-climb indicator, combined statoscope and rate-of-climb indicator, ground speed indicator, several types of aircraft sextants, an astronomical position finder, horizontal angle indicator, tachometers, air-speed indicator for dirigibles, and a ballonet volume indicator for lighter-than-air craft. Tests of these instruments show them to be in nearly all cases satisfactory for the purposes intended.

In order to keep in close touch with the latest developments in aeronautic instruments in foreign countries a representative of the Bureau has been detailed abroad for the last three months of the fiscal year. Special attention has been paid to the lighter-than-air craft work now under way in England, France, Italy, and Germany, and valuable information has been secured.

Very complete equipment is now available for investigations in aerodynamics, as two wind tunnels are at present in service and a third is under construction. The largest tunnel at present in use is of octagonal cross section, with a distance of 54 inches between opposite faces. This tunnel is equipped with two balances, one for work of the highest precision and the other for rougher determinations, and wind speeds from 17 to 90 miles per hour may be secured. A 36-inch circular tunnel is also in use, in which a wind speed from 11 to 180 miles an hour is obtainable. The tunnel now under construction will be 10 feet in diameter, and it is planned to provide for a speed range the same as that of the 54-inch tunnel. During the past two years a thorough study has been made of the aerodynamical

characteristics of drop bombs, in cooperation with the Ordnance Department of the Army. The investigational work is now well under way, and by means of a novel method, devised by Maj. F. C. Brown, it has been possible to study accurately the characteristics of the fall of a bomb from an airplane. In cooperation with the Balloon and Airship Division of the Air Service a study is being made of the air flow around the wind screens used to protect dirigibles when entering and leaving their hangars. Recommendations have been made which will lead to the use of an improved screen. Further investigations have been conducted of the resistance of spherical bodies in an air stream; a very interesting subject, because of the extreme sensitiveness of the flow about spheres to turbulence in the air stream. It has been shown that roughened balls, such as golf balls, have less resistance than smooth ones. An interesting investigation on roof ventilators for buildings has been brought to a conclusion during the year and a technologic paper will probably be issued on the subject. The usual routine tests of airplane models, air foils, and aircraft instruments have been made.

STRUCTURAL, ENGINEERING, AND MISCELLANEOUS MATERIALS.

This work includes the testing and investigation of all the materials ordinarily employed in engineering and industrial work. Many of the sections of the Bureau which are engaged in research and testing along these lines are equipped with small-sized manufacturing plants, so that the actual conditions met with in the industries can be studied.

In the work on metals an increasing amount of attention is being paid to fundamental investigations, the amount of routine testing having decreased considerably. As the results of these routine tests were seldom of much scientific value, the change is a beneficial one. The testing equipment has been overhauled and is now in excellent shape. The investigation of large H-section columns in cooperation with the American Society of Civil Engineers has been continued and results which may lead to a more economical design for such members have been secured. Strain gage measurements were made on welded and riveted steel tanks and data were collected on the advisability of raising the allowable stresses in steel for building construction. It was concluded that sufficient information is not yet on hand to warrant this being done. The data secured through strain gage measurements of the floors of the Arlington Building have been prepared for printing and will soon be published. Strength tests are being made of hollow-brick walls, and if the results are satisfactory, a direction for economizing in building construction may be pointed out. Considerable time has been spent on the investigation of metals for airplane construction. This has included stream-line wires and

the light alloys of aluminum used for making wing surfaces, etc. It has been shown that failure by fatigue is an important point to consider in using these materials. At the request of the Navy Department experiments were conducted on body-bound bolts and it was found that a tight fit could be secured by shrinking the bolts with liquid air, or by expanding them with an explosive charge placed in a hole drilled along the axis of the bolt. Some experiments have been made on the strength of screw threads in cooperation with the National Screw Thread Commission. Calibrations of testing machines have included a comparison calibration of the 2,000,000-pound chain testing machine at the Boston Navy Yard and a 1,000,000-pound hydraulic press belonging to the Bureau. In both cases the machines tested read high as compared with the standard machine of the Bureau. In all, 780 tests were completed during the year.

No new investigations on the constitution of Portland cement were undertaken during the year. Several lots of magnesite have been calcined under controlled conditions, and from the resulting calcine typical mixtures for a flooring and for a stucco composition have been made. The marked effects of different aggregates on the same calcine were noted. The elaborate test of a concrete and hollow-tile floor slab at Waynesburg, Ohio, was completed. It was impossible to produce failure of any of the panels with the maximum load which could be piled upon the slab. In the case of the largest panel, the final load was 18.6 times the safe load allowed by present calculations. This indicates a chance for more economical construction through the employment of higher allowable stresses. It appears from an analysis of stresses in slabs, undertaken in cooperation with the American Concrete Institute, that more attention ought to be paid to the tensile strength of concrete, a factor which has been neglected heretofore. A total of 759,051 barrels of cement were shipped on the basis of Bureau certification during the year. This represents quite a decrease from the previous fiscal year, and for this reason inspection at several plants was discontinued. The Bureau's branch laboratories at Pittsburgh, Northampton, Pa., Denver, and San Francisco are still maintained however, and some of them are equipped to do a small amount of miscellaneous testing in addition to cement work. A digest is being prepared both in the form of a chart and as a pamphlet on foreign cement specifications, and should prove of considerable value to exporters.

Some new equipment has been added to the Bureau's rubber laboratory, so that it is now possible to carry out the compounding and vulcanizing operations which are necessary in some parts of the work. Considerable difficulty has been experienced in the laboratories with the commercial rubber tubing bought in the open market, and for this reason the rubber laboratory experimented on different

processes of making this material and was so successful that now the entire Bureau is being supplied. The cooperative work with the Department of Agriculture on rubber jar rings has been continued during the year and will be supplemented with actual service tests. The power losses in automobile tires are being studied with the aid of a dynamometer specially designed for this purpose. By the use of this apparatus it is possible to determine with accuracy the amount of power dissipated in heat in different kinds of tires and inner tubes. This may lead to some interesting data for the design of tires. It is planned in the near future to study the effects of different ingredients on the properties of rubber and preliminary work has been started. A large number of samples of rubber goods and materials and of miscellaneous articles are tested for the Government departments, the General Supply Committee, and in a few cases for private parties. The Bureau is cooperating to the fullest possible extent with manufacturers, States, and municipalities in the preparation of specifications to govern the purchase of rubber goods of all sorts. Among these may be mentioned specifications for tires and tubes and for fire hose.

The investigation, which has been in progress for some time, on the comparative durability of leather tanned and filled with vegetable tanning materials and leather tanned and filled with sulphite-cellulose extract, is now nearly completed. It would appear that the use of sulphite cellulose does not affect the durability of the leather. Twenty service tests of waterproofed and nonwaterproofed oak sole leather show but little difference in the durability. The investigation of shark-skin leather for shoe uppers has been continued and is still in progress. The results indicate that this leather is as durable as calf and does not scuff or peel so much. The comparative durability of hogskin and calfskin uppers will also be studied.

The textile laboratories have been put in excellent shape during the year. The constant-humidity room is now finished and the cotton-mill equipment is complete. Specifications have been prepared for a number of the Government departments covering a wide variety of textile materials, and in cooperation with the National Association of Woolen Manufacturers quite an extensive investigation of woolen products is to be undertaken. The microscopic study of textiles is receiving more and more attention. The Bureau is collecting many representative samples to use in microscopic identification work. The investigation of balloon fabrics has been continued, and a certain minimum thread count, which such fabrics should possess, has been decided upon. A thorough investigation, including tests in the constant-humidity room, was undertaken at the request of a large selling house, to decide upon a proper tolerance for the length of blankets. Very helpful cooperation was

secured for the parties requesting the test and from the manufacturer of the blankets, and interesting results have been secured. Preliminary work has been started on the problem of utilizing low-grade cotton, and the variables in cloth have been studied.

As just mentioned in connection with the work on textiles, the paper laboratories have likewise been placed in first-class condition during the year. Some new machinery has been added and the successful operation of the constant-temperature humidity room has added greatly to the facility with which certain kinds of tests can be carried out. A stain has been developed by which it is possible to differentiate between sulphite and sulphate pulp in paper, as the two classes of fibers show different colors when treated with this stain and then viewed under a miscroscope. Considerable time was devoted to an attempt to produce a satisfactory paper for making electrical condensers. A paper sufficiently free from magnetic particles was run off on the Bureau's paper machine, but the thickness was greater than is desirable. However, it is thought that by making some alterations in the machine a satisfactory paper can be produced. Tests to determine the sizing quality of paper have been studied with a view to their improvement, and it is thought that an electrical conductivity method will prove satisfactory. A circular on paper testing (Circular No. 107) was issued during the year in response to many requests.

General problems of lubrication and the use of different instruments for determining the properties of oils and similar substances have been studied as heretofore. A paper on the MacMichael viscosimeter was published by the Bureau of Mines, the experimental work having been done in cooperation with that bureau. The new Saybolt viscosimeter was described in a report of one of the committees of the American Society for Testing Materials. The subject of plastic flow has been thoroughly investigated, and has included cooperative work with the Bureau of Home Economics of the Department of Agriculture. Routine tests were made on 661 samples of oils for Government departments and on 51 samples for private parties.

In connection with the study of lime, gypsum, and sand-lime brick considerable progress has been made. The fellowship established by the Gypsum Industries Association has been continued, and another was established by the National Lime Association. Visits have been paid when possible to manufacturers' plants and their problems studied. The effect produced by the addition of hydrated lime to concrete has been investigated, and further work on the causes of the popping of lime plaster will be carried out in cooperation with the National Association of Plastering Contractors, the International Plasterers' Union, and the National Lime Association. The instru-

ment designed by the Bureau to measure the plasticity of hydrated lime has received the official sanction of the National Lime Association.

Means for causing the quick setting of lime plaster have been investigated, and the Bureau is working on a standard consistency of sanded gypsum plasters. Standard requirements for fineness of calcined gypsum are also being investigated. Heretofore calcined gypsum has not been sufficiently plastic to be entirely satisfactory as a plastering material. This difficulty has been overcome in the past by the addition of other substances. However, through the efforts of the Bureau a method of controlling the manufacturing process has been discovered, by means of which it is possible to produce gypsum which is sufficiently plastic for all purposes. The great value of this discovery can be easily appreciated. The patent covering this process has been dedicated to the public, and many plants are installing equipment for manufacturing the new product.

METALLURGY.

The metallurgical work of the Bureau is concerned with research in the field of products metallurgy as distinguished from process metallurgy, this last having to do with the extraction of metals from their ores, work which is carried on by other bureaus of the Government.

Many important investigations have been conducted during the year and in several cases the work has yielded valuable results. New etching methods have been developed for the metallographic examination of nonferrous alloys, and the studies of etching various kinds of steel have been continued. A reagent consisting of an aqueous solution of ammonium persulphate has been found to reveal most of the structural features of iron and steel, which are ordinarily only revealed by deep etching, and has the advantage of not spoiling the specimen for further examination.

The investigation of the structural changes which accompany the tempering of hardened steels is about one-half completed, but more than 400 additional specimens must be examined to finish the work. An investigation similar to that carried out on lead is now being conducted on the embrittlement of other soft metals, and a study is being made of the corrosion of chromium steel. The investigation of the distribution of phosphorus in low-carbon steels has been completed and the results are being collected for publication.

Six research associates and assistants in metallurgy have been stationed at the Bureau during the year and have done valuable work for the industries and organizations which they represent, the results of their investigations being, of course, equally available and valuable to the Bureau. This work has included the quantita-

tive determination of the amount of iron in brass, a study of the Sherardizing process, researches in monel metal, a study of nickel, an investigation of deoxidizers and slags, and a study of red shortness of iron.

CERAMICS.

The ceramic industries are of basic importance to the country, and in spite of the fact that many of them are long established they have received comparatively little expert scientific attention. The investigations of the Bureau are therefore of more than ordinary importance, and have been gladly received by the industry in general.

During the past year the investigation of "fish scaling" of metal enamels has been continued, and it has been found that this trouble is due to a difference in the coefficient of expansion of the enamel and the metal on which it is placed. Wet processes of enameling small articles, such as stove fittings, have been studied, and it is believed that this work will suggest means for improving the process. Some work has been carried out on white enamels for copper, which will form the basis for a paper on this subject. The study of the relation of the composition of enamels to solubility in acids has been completed, and an investigation is in progress on the replacement of tin oxide in enamels for sheet steel.

A study has been completed on high-fire porcelain glazes, which are important for making chemical porcelain ware, spark plugs, and pyrometer tubes. The crazing of pottery has been investigated, and it has been shown that probable variations occurring from time to time in the silica content of the clays used are sufficient to account for the occasional recurrences of crazing. A paper is in course of preparation on the solubility of feldspar frits, and an important investigation is nearing completion on the properties of domestic ball clays as compared with those of English origin. This work will enable American manufacturers to tell with greater certainty what results are to be expected from domestic clays.

In cooperation with the National Terra Cotta Society progress has been made on problems relating to the use of architectural terra cotta.

The transverse strength of fire clay under severe conditions of temperature and load has been thoroughly investigated, and it has been shown that above 1,300° C. the transverse strength is a negligible quantity from the standpoint of design. American bond clays for glass pots have been investigated in comparison with the Gross Almerode clay, and it has been shown that each kind possesses certain advantages for this purpose. Different combinations of clays and "grogs" have received attention, as well as special material for refractory tubes.

Steady progress has been made in connection with optical glass. About 30,000 pounds of experimental melts have been made, including several different kinds of glass. Improvements have been made in the methods of molding and annealing the lens blanks, prisms, etc. More than 1,500 pounds of optical glass in the form of lenses and prisms have been delivered to the Navy Department during the year. This has included the production of lens disks 15 inches in diameter. An investigation has been made of the manufacture of colored glass for special uses in optical instruments and some promising results have been obtained.

Specifications are in course of preparation covering other kinds of glass articles, such as tableware and sheet glass, and in this work the Bureau is receiving the cooperation of other Government departments and the industries.

Appendix E.—ABSTRACT OF REPORT OF THE COMMISSIONER OF THE BUREAU OF FISHERIES.

(HUGH M. SMITH, *Commissioner.*)

RELATIONS WITH THE FISHERY INDUSTRIES.

The American fishery industries have been confronted with one of the most serious situations in their history. A post-war decline in consumption of fish at home and abroad, following a war-time expansion of operations, necessitated a heavy curtailment in production and a marked reduction in producers' prices, while the costs of labor, materials, and transportation were still advancing. Retrenchment has been particularly noteworthy in the salmon and sardine industries and in the New England bank fisheries. Appeals to the Department for assistance in overcoming adverse conditions, in effecting economies of operation, and in improving methods of capture, merchandising, and transportation have exceeded all previous demands.

The helpful efforts of the Department in this field have included aid in increasing the consumption of staple fishery products of which there was an oversupply, such as fresh haddock, canned pink and chum salmons, and various kinds of frozen fish; initiation of a series of surveys of certain primary markets, to supply data for the guidance and use of the trade in extending the demand for fish; aid to producers in promptly obtaining and transporting materials, such as salt and barrels, required for immediate use when fish are running; practical advice for increasing the utilization of by-products of the fisheries, especially meal, fertilizer, oil, leather, fish scales, and shark fins; demonstration of new methods and the dissemination of information looking to improvement in methods of the fisheries, including preservation of fish nets, and the salting, precooling, and freezing of fish in brine; recommendations for improvement in the methods of handling fresh fish on vessels, at docks, and in transit to secure better quality and prevent waste; and the effectuation of extended trials of sea planes as adjuncts of the fisheries, fully demonstrating the utility of air craft in locating schools of fish.

Advancement in some phases of the fishing industry has been slower than in other comparable industries, and a noteworthy part

of the product of the fishermen's labors is wasted through faulty methods. The annual losses represent millions of dollars to the business and millions of pounds of food and materials required in the arts and industries. The opportunity that is thus presented to the Department to serve the general public through aid to one of the country's basic industries should be fully availed of, and should receive substantial recognition from Congress. Up to the present time inadequate provision has been made by the Federal Government for rendering to the fisheries the technical assistance that the industry has reason to expect and as a whole can obtain through no other agency. The Department has increased its facilities and the volume of its activities for serving the various branches of the fisheries, and has instituted a number of investigations that should soon yield helpful results, but the field is large and there is need for energetic and augmented service that can not be performed without additional congressional appropriations. As an example of the practical value of the efforts recently put forth in behalf of the industry, reference may be made to the fact that the work done by the Bureau demonstrating an improved method of utilizing the menhaden added more than $100,000 to the value of the fish products of a single community on Chesapeake Bay in a single season—a sum five times as large as the appropriation available for this branch of the service.

The possibility of adapting foreign methods of freezing fish in brine to the requirements of the industry in the United States is attracting unusual attention throughout the country, and work now in progress gives promise of effecting important improvements in practice. The Department has been a pioneer in disseminating information concerning the processes and principles involved. It imported and installed the first brine-freezing plant in the United States, and has used it to demonstrate the method to persons in the fishery industry as well as to Federal officials interested in freezing fruits, vegetables, poultry, and meats. There has been provided equipment for technological investigations to develop information which the industry now lacks and which will be of value in adapting brine freezing to the needs of the American fisheries.

It is planned to extend the series of fish-market surveys to at least 10 important centers; to increase the service for bettering the methods of handling, distributing, and marketing fishery products; to complete certain technological investigations in the canning of west coast fishery products; to include in the statistical program a canvass of the fish-canning and fish-fertilizer industries of the Atlantic seaboard, and to continue the publicity and demonstration work to increase the use of fish and fishery by-products.

ALASKA FISHERIES.

The salmon fisheries of Alaska so far outrank all other branches of the fishing industry of the Territory that in the discharge of the regulatory functions of the Department attention is chiefly devoted to the protection of the salmons. During the active fishing season of 1920 the regular staff of wardens and agents was supplemented by a corps of temporary employees, including one person detailed for the purpose by the governor of Alaska. For the season of 1921 the patroling force was further augmented and was more efficient than ever before, but a further substantial increase in this personnel is necessary to prevent illegal operations.

The Alaska fisheries as a whole in 1920 showed a falling off in both quantity and value of product, although there was an increased yield of herring, cod, and halibut as compared with 1919. The principal factor in the decline was the reduced output of canned salmon in southeast Alaska. Statistics collected and compiled by the Department show that in 1920, 27,482 persons were employed in the fisheries, the capital invested was $70,986,000, and the value of the products was $41,492,000. The output of canned salmon was 4,429,463 cases of forty-eight 1-pound cans, valued at $35,602,800, a decrease of 3 per cent in quantity and 17 per cent in value as compared with the previous year. The country's general industrial situation seriously affected the Alaska salmon industry in 1921. Only about one-half of the canneries was operated, fishing fell off in consequence, and the attention of fishermen and canners was directed mostly to the higher-priced kinds of salmon. This decline in business due to market conditions was in part compensated for by an unusually large escapement of salmon to the spawning grounds, the results of which should be seen in increased runs two to five years hence.

In October and November, 1920, five hearings were held to consider the necessity for imposing additional restrictions on the taking of salmon in Alaskan waters, and as a result the Department issued orders effective January 1, 1921, closing certain rivers to commercial fishing, so as to insure an adequate escapement of salmon to the spawning grounds and restrict the fishing in the rivers to the non-commercial needs of native and white residents. Out of consideration for companies having investments in local fishing properties the new regulations for the Yukon, Kuskokwim, and Copper Rivers contained exceptions whereby commercial fishing was permitted to continue until September 1, 1921. Further hearings in the fall of 1921 are expected to develop information showing the desirability of placing additional restrictions on salmon fishing in the waters of northern and western Alaska and of extending the closed zones off the mouths of streams in southeastern Alaska.

Need for revision of the Alaska fishery laws is apparent to everyone who has given the matter consideration, and during the existing period of reduced operations new regulatory measures can be applied with the minimum effect on the industry. The subject should receive the prompt consideration of Congress. The Department is not concerned over the minor details of legislation, on which much discussion has heretofore been expended, and will welcome any law that takes cognizance of the condition of the Alaska salmon supply and makes provision for the perpetuation of that supply through proper regulation. Until a new general fish law may be enacted, special measures may be necessary to meet particular situations. In this class is a bill now on the calendar of the House of Representatives extending for a distance of 3 miles the jurisdiction of the Department off the mouths of salmon streams in Alaska, in order that the activity of fishing operations in such areas may not imperil the future runs through the capture of too large a percentage of the spawning fish. The jurisdiction of the Department under existing law extends only 500 yards from the mouth of salmon streams—an authority that is quite inadequate to meet conditions that have been arising in the course of the extraordinary development that the salmon industry has undergone. The bill has received the approval of the Department and its early passage is urged.

ALASKA FUR-SEAL SERVICE.

The exceedingly valuable herd of fur seals resorting to the Pribilof Islands has continued to increase in response to the protection afforded by the discontinuance of pelagic sealing, and the utilization of the surplus male seals killed under Government supervision is a profitable business. New methods of taking and curing sealskins have been undertaken on an extensive scale, and improvement in the quality of the fur has resulted.

Sealskins secured in 1920 numbered 26,648, practically all from animals three or four years old. The number taken in 1921 through the regular killing season that ended on August 5 was 22,546, chiefly from seals three years old. The census of the seal herd in 1920 indicated 552,718 seals of all ages as of August 10, of which 167,527 were breeding females and the same number of newborn young. The 1921 census showed the existence of 587,820 seals of all ages, of which 176,655 were breeding females with a like number of young. The aggregate strength of the herd according to these figures did not include the seals killed in each of the years named.

In February, 1921, the Department entered into a contract with the Fouke Fur Co., of St. Louis, for handling the Alaska sealskins. This is the only company in the United States fully equipped for dressing and dyeing large numbers of sealskins in a manner equa

to the best practices of the fur trade, and the Department is glad to be able to lend support to this newly established American business. During the fiscal year 1921 two public auction sales of finished sealskins were conducted at St. Louis; 20,180 dressed, dyed, and machined skins were disposed of; the gross proceeds of the sales were $715,404, and the net proceeds $342,701.29. The Department has deposited in the United States Treasury the sum of $99,983.54, representing the net proceeds of the sale of sealskins during 1921, and in addition thereto has paid to the Governments of Great Britain and Japan the sum of $31,825.35 each, representing their shares under the sealing convention of July 7, 1911.

Another valuable natural resource of the Pribilof Islands is a herd of blue foxes, which are practically dependent for food on the carcasses of seals killed for their pelts. Under the careful handling this herd is now receiving, the number of animals has steadily increased and the yield of skins has become larger than ever before under Government auspices. The fox pelts taken during the winter of 1919–20, numbering 901 blues and 37 whites, were sold at public auction in St. Louis in February, 1921, for $80,699. During the winter of 1920–21, after an ample breeding reserve had been released, the Department's agents took 1,125 blue foxes and 14 white foxes whose skins will be sold in due course.

The 325 native inhabitants of the Pribilof Islands are Government wards and dependent for their very existence on the food, shelter, fuel, and clothing provided for them by the Department. They are likewise furnished medical service and school facilities; and in general exhibit satisfactory mental, physical, and material progress. They have creditably performed the work required of them in connection with sealing, foxing, and other operations, and are given every opportunity to become self-reliant and self-supporting to the full extent permitted by their environment. In transporting the annual supplies required on the Pribilof Islands for the maintenance of the natives and the Government officials and their families and for the management of the seal and fox herds, the Department has had the invaluable assistance of the Navy Department. The radio tender *Saturn* made two trips to the islands with freight and passengers, and also carried to Seattle the season's take of seal and fox skins. Vessels of the Coast Guard likewise rendered useful service in transporting supplies.

In view of mutual international pecuniary interests in the various seal herds of the North Pacific Ocean and Bering Sea, under the terms of the convention signed at Washington on July 7, 1911, an inspection of the Alaskan, Japanese, and Russian seal rookeries by a properly constituted international commission would be desirable, to ascertain the present conditions and to place the respective Govern-

ments in possession of information on which to base future action for the preservation of the fur seals.

BIOLOGICAL INQUIRIES AND EXPERIMENTS.

Nothing can be of more importance to the welfare of the fishery industries than the maintenance of an adequate supply of fish in public waters, but the correct determination of measures to perpetuate and increase fishery resources must be based on knowledge of the essential facts as revealed by the application of science to fishery problems. This is the primary field of the scientific inquiries conducted by the Bureau.

The well-known decline of some of the most valuable fisheries should be an effective warning that in the past proper consideration has not been given to the vital matter of conservation, and should encourage the more direct and extensive application of scientific studies in the future. Past mistakes with regard to the maintenance of aquatic resources have not served in any way to simplify the economic problem of production and distribution but rather the reverse. Difficulties in marketing have an intimate relation to the prices at which products are sold as compared with competing products; the prices of fish, for example, are compared with the prices of meats, and the general trend of prices must be upward as the available supplies decrease relatively to the demand for protein food. Yet while we as a people have devoted much energy and technical skill to the problems of increasing production of land animals, we still make scant provision for acquiring the knowledge necessary to conserve and develop our fishery resources.

The chief limiting factors of the Bureau's scientific work at the present time are not only the small appropriations available but also the difficulty in securing competent employees at the salaries offered and in holding those who have acquired special training and skill in the service; thus, nearly 50 per cent of the technical positions have been vacant during the greater part of the past fiscal year.

The activities under this head may be generally classified as dealing with life histories, habits, and propagation of fishes, with fish-cultural experiment work, and the diseases of fishes, with the use of fish in combating diseases of man, with the propagation and protection of shellfish (primarily, at the present time, oysters and fresh-water mussels), with general surveys and a few special problems, and with the maintenance of laboratories for such purposes.

The Pacific salmons have received special attention on account of the importance of the industries which they support and the demonstrated need of more adequate provision for the preservation of the fisheries. Investigation of the destructive practices of taking immature salmon in the sea off the coast of Pacific States, marking experi-

ments with young chinook salmon propagated and liberated in the rivers followed up by capture and study of marked fish returning to spawn, and studies of runs of salmon in Alaskan rivers have yielded some results useful in guiding the work of propagation and in framing measures of regulation. Substantial contributions have been made to knowledge of the life histories of marine fishes, and further practical work on the commercial species of fish would have been accomplished but for the loss of the personnel assigned to this work. Another major investigation has been directed to the white fishes and related species of the Great Lakes, upon which are based the most important fisheries of these waters. Attention has been given, too, to the fishes of interior lakes, valuable both as articles of food and objects of sport, and to the disappearing paddlefish of the Mississippi basin.

The fish-cultural experiment work, centered primarily at the fisheries biological station at Fairport, Iowa, has the object of establishing a better scientific basis for fish culture either as a public undertaking in public waters or as a private enterprise in privately controlled waters, such as ponds and streams on farms. In purpose it is directly comparable to agricultural experiment work, although fish-cultural science, as compared with agricultural science, is as yet in an early stage of development and very limited in extent. The work conducted has been concerned with valued food fishes, such as trout, catfish, buffalofish, and bream, as well as with the food supply of fishes and other conditions of the successful practice of fish culture. In proportion to the facilities and personnel available, noteworthy progress has been made. With such work is closely associated the investigation of the diseases of fishes, the control of which forms no insignificant part of all fish culture.

It is now a familiar fact that small fish in inclosed waters play some part in the maintenance of healthful conditions, wherever malaria-bearing mosquitoes occur. Investigations conducted by the Bureau have not only determined the conditions of the control of mosquitoes by fish but also have revealed great possibilities of extension of the use of fish for this purpose, with consequent promotion of economy and efficiency through improvement of community health. The practical service rendered during the year to the United States Public Health Service and to State and local health officials has brought gratifying evidences of appreciation and such convincing statements of economies effected through advice given as abundantly to justify the temporary detail of an assistant in this practical service. The Bureau has not, however, rested with giving advice based upon previous investigations, but has continued the experimental and observational work necessary to effect further improvements in methods of application of fish control for elimination of mosquitoes.

In the field of general surveys special attention has been devoted recently to the Gulf of Maine, the Chesapeake Bay, the Mississippi River, and certain inland lakes. The portion of the north Atlantic termed the Gulf of Maine, which includes some of the great fishing banks, is one of the country's most important sources of fish food supply, and the investigations under way are intended to remove much of the cloud of obscurity veiling the distribution, life histories, and conditions of life of our most valuable commercial fishes. Such knowledge is necessary to inform us to what extent we can tap the resources of the sea without irreparable loss, and may perhaps form the basis of predications of the yearly and seasonal abundance of particular fishes. Chesapeake Bay is the largest arm of the sea entirely within our boundaries and the scene of important fisheries, not only for fishes but for oysters, blue crabs, and other shellfish. A very practical purpose is, therefore, served in acquiring the information necessary for interpretation of the seasonal and irregular movements of fishes in the bay and for the solution of practical problems that arise from time to time regarding fish and shellfish. Special attention is being given to a study of the distribution and movements of fish in the bay and tributary waters.

A result of particular note has accrued from the investigation of native seaweeds as material for the manufacture of gelatines useful in commerce. One of the most valuable of gelatines is the agar-agar for which the United States has always been dependent upon oriental sources of supply. Agar-agar has many commercial uses, but owes its importance primarily to the fact that it is an indispensable material in medical laboratories and hospitals. A constantly available supply may be said to be essential to national security. The investigations conducted by the Bureau during the past fiscal year have shown that certain seaweeds of the Pacific coast will yield agar-agar that meets the most exacting requirements.

The Bureau has continued its efforts to solve the difficult problems confronting the oyster-growing interests, particularly in the Long Island Sound region, where the areas under cultivation are regularly diminishing for want of seed and the whole industry has been threatened with extinction. The season of 1920 proved very unfavorable for experimentation, but the outlook for profitable work during the season of 1921 is particularly promising. Special attention has been given to the effect of pollution upon oyster propagation.

Fresh-water mussel propagation has been conducted as usual and, partly through the liberal cooperation of the National Association of Button Manufacturers, the output of larval mussels during the last season was greatly in excess of previous years. The number of such larvæ artificially implanted on the gills of appropriate fish hosts was approximately 648,000,000. The efforts of the Department

to awaken interest in the protection of the mussel resources have continued to meet with favorable responses, so that the areas now under strict protection have been materially extended.

Reference may be made to the fact that in July, 1921, a conference between representatives of the States of Maryland and Virginia and of the Department was held in Washington to settle the much-vexed problem of the protection of the blue crab of the Chesapeake Bay upon the basis of recommendations arising from an investigation of the life history and migrations of the blue crab previously carried out by the Bureau in the regular course of its scientific work. Essential measures of protection were agreed upon, and the State officials will endeavor to secure concurrent legislation to give effect thereto.

Among the most gratifying occurrences of the year have been the cordial responses to the invitations given on two occasions by the Department for conferences on the subject of the conservation of resources of interior waters. The first conference, held on the occasion of the dedication of the new biological laboratory at Fairport, Iowa, was attended by scientific men from 12 States and, in devoting special attention to the application of science to fishery problems, gave substantial aid to the Department in framing plans for constructive service to the fisheries. The outcome of this conference indicated the advisability of another of broader scope and longer duration, which was held at the same place in June, 1921. It was attended by a large number of commercial men, anglers, and scientists, besides representatives of State governments and several Federal bureaus, and proved most helpful in effecting both an interchange of ideas and a better understanding among persons of varied interests. Some practical results became almost immediately apparent in the steps which have been taken to give broader protection to fishery resources.

POLLUTION OF WATERS.

The rapidly increasing pollution of both fresh and salt waters resulting from development of industry has created alarm among fishermen and undoubtedly in many cases has caused much harm, both to the fishes and fishing gear. This has been particularly true of petroleum and its products, but there is a great variety of industrial wastes which are either known to be harmful or are suspected of being so. There are very few experimental data and little specific information on the subject, such as can be used in courts of law or before legislative bodies, and it is important that such data should be acquired and made available. On the one hand, the fisheries should be protected from preventable pollutions and, on the other, industry should not be harassed and subjected to unnecessary expense in the disposal of innocuous substances resulting from legitimate and essential operations.

It is desirable that investigations should definitely determine what pollutions are injurious, to what extent they may be converted into harmless substances after they are discharged, and what measures are feasible for rendering them innocuous before discharge or for recovering them as economic by-products. It is desirable to learn also which fishery products are affected and under what conditions, and which are resistant to the effects of these different trade wastes.

To enable the Department to carry on the proposed investigations an item of $7,500 has been included in the estimates of appropriations for the next fiscal year.

PROPAGATION OF FOOD FISHES.

In considering the service rendered by the Department in propagating food fishes and distributing them in the public and private waters of the country, the question arises whether the Federal Government has been performing a function that should be assumed by the respective States. There can be little doubt as to the propriety of efforts of the Government to maintain and increase the supply of food fishes in coastal waters, interstate streams and lakes, and boundary waters, but there is grave doubt as to the propriety of propagating and planting fish in the minor waters wholly within the States, especially when such waters in many cases are not open to the public.

In the absence of a definite policy in this matter, Congress has from time to time ordered the establishment of numerous hatcheries apparently without any regard for the responsibilities and duties of the States. Hatcheries have been located in States that were already maintaining hatcheries of the identical nature and purpose as those provided by Congress, and were able and willing to build additional hatcheries as occasion demanded. On the other hand, hatcheries have been placed by act of Congress in States that have exhibited little or no inclination to aid themselves by this direct means of perpetuating their local fish supply and, in some cases, have been quite indifferent in the matter, as shown by their failure to afford even the minimum degree of protection required for the maintenance of the various kinds of food fishes within their limits. Much effort and much money expended by the Department in hatching and planting fish have been wasted because certain States have failed to render proper cooperation. A logical policy for the Government to pursue would be to look to the States for the conduct of such fish-cultural operations as may be required for the maintenance of the fish supply in minor local waters, leaving to the Federal Government the establishment and maintenance of hatcheries for fishes that support commercial fisheries or contribute materially to the country's food supply in coastal, interstate, and boundary waters. The proper disposition

to be made of the existing Federal hatcheries that serve a relatively local need remains to be determined, but assuredly no additional hatcheries of this kind should be established without a very careful consideration of the whole subject by Congress.

Meanwhile, in order to make the fish-cultural work at least partly self-sustaining and to bring to an end a practice that can no longer be regarded as necessary or desirable, a proviso has been inserted in the estimates of appropriations for the next fiscal year authorizing the Secretary of Commerce to impose a reasonable charge for all fish furnished by the Bureau for planting in private waters in which the general public is not permitted to fish, the moneys received from this source to be covered into the Treasury.

The hatcheries are maintained to meet definite requirements and their output reaches every State. The bulk of the eggs incubated in the field operations are taken from fish that have been caught in commercial fishing and are on their way to market; unless salvaged by the fish culturists they would be lost. During the fiscal year 1921, the department produced and distributed 3,626,263,000 fry, 226,589,000 fingerlings, and 1,109,637,000 fertilized eggs, a total of 4,962,489,000.

An extensive and highly productive branch of the fish-cultural work is the rescuing of stranded food fishes from overflowed lands in the Mississippi valley. The fish are left by the receding flood waters, and unless collected and planted in the main streams will inevitably perish when the temporary waters in which they are inclosed become dry or frozen. In 1921, the rescued fish, consisting of all the important food species found in the Mississippi River and tributaries, numbered over 120,000,000. These operations, which at minimum cost produce the most noteworthy results, continue to be commended by everyone familiar with their character. There is excellent opportunity for an extension of the work into fields not now occupied; and the Department has made a favorable report on a bill which provides increased facilities and personnel for this purpose.

The Department has entered into profitable cooperative relations with the Canadian Government in the conduct of fish-cultural operations addressed to the commercial fishes of the Great Lakes. There is also intimate and mutually helpful cooperation with the various States which are engaged in artificial propagation. In the national parks and national forests the Department has undertaken to keep the waters stocked with suitable fishes and to establish desirable species in previously barren waters; and, in active cooperation with the Government officials in charge, is rendering a valuable service in making these great national playgrounds more attractive to visitors. Hatcheries are maintained in the Yellowstone National Park and the Glacier National Park, and large deposits of fish are being systematically made in park and forest waters that are most fished.

Appendix F.—ABSTRACT OF REPORT OF THE COMMISSIONER OF THE BUREAU OF LIGHTHOUSES.

(GEORGE R. PUTNAM, *Commissioner.*)

The United States Lighthouse Service, under the Department of Commerce, is the largest organization of its kind in the world, having charge of the lights, buoys, and other aids to navigation on all the sea and lake coasts of the United States. It maintains about 16,000 aids, employs about 6,000 persons, and operates about 120 vessels.

For purposes of administration, the coast is divided into 19 lighthouse districts, each in charge of a superintendent of lighthouses, who is located in a maritime city in the district. The Great Lakes comprise the tenth, eleventh, and twelfth districts, with district headquarters at Buffalo, Detroit, and Milwaukee, respectively. The superintendent of each district is the chief executive of lighthouse work under his charge, with important and responsible administrative and technical duties, being an engineering as well as an executive officer. Each superintendent is responsible, taking the average of all the districts, for Government property of $4,000,000 estimated value, 7 vessels, the marking of 1,000 miles of general coast line, 860 aids to navigation, 320 employees, and $400,000 annual disbursements.

Some of the qualifications necessary for this duty are: (1) Technical knowledge of lighthouse work; (2) business ability for its economical and efficient handling; (3) vigilance in protecting the safety of navigation; (4) training and experience in practically all branches of engineering; (5) nautical knowledge and experience; (6) efficient supervision of a widely scattered personnel; (7) ability to act on independent initiative and responsibility; and (8) ability to act and cooperate with representative citizens, and local or other Government officers in matters affecting the needs of navigation.

The headquarters of the entire Service is in Washington, under the Commissioner of Lighthouses, who, with three principal technical assistants, has the management and direction of the entire work, involving not only the maintenance and operation of the lighthouse system, but designs and construction of new lighthouses, vessels and related structures, as well as their repair and improvement.

MORE IMPORTANT ACTIVITIES OF THE LIGHTHOUSE SERVICE DURING THE YEAR.

Three radio fog-signal stations, the first in this country, were placed in commission by the Lighthouse Service on May 1, 1921. These are on Ambrose Channel Light Vessel, Fire Island Light Vessel, and at Sea Girt Lighthouse, all in the vicinity of New York Harbor. These stations are the result of experiments carried out during several years by the Bureau of Standards and the Lighthouse Service in cooperation, and of the development of a practical radio compass by the former. A public demonstration of the working of these stations, and of the use in connection therewith of a radio compass mounted on a vessel, was given on the lighthouse tender *Tulip* in the vicinity of New York on June 27 and 28, 1921. This system should give to the navigator, for the first time, a means of taking in a fog, or time of low visibility, accurate bearings of invisible lighthouses and light vessels, which he may use in locating or steering his vessel, and he should be able to do this independently as he uses his magnetic compass for bearings on visible objects. When developed and its use extended, radio fog signals and the radio compass will probably be the greatest advance made in a long period in affording protection to vessels in fog, and should be the means of avoiding some of the serious marine disasters now due to inability to locate a fog signal under unfavorable conditions.

Congress by the act of March 4, 1921, appropriated $1,000,000 for vessels for the Lighthouse Service, a part of the $5,000,000 vessel rebuilding program which was authorized by the act of June 5, 1920. Plans and specifications were promptly prepared and bids opened on June 21, 1920. They were found so favorable that it was possible to contract for five identical light vessels at an average cost of $184,000 each.

During the year the new lighthouse at Point Borinquen, the northwestern extremity of Porto Rico, was finished, complete new systems of aids to navigation were established for Keweenaw Waterway, Lake Superior, and for Fighting Island Channel and Detroit River, Mich., and the new plate shop and coal shed at the general lighthouse depot on Staten Island, N. Y., were completed.

Important improvements and construction were in progress at lighthouse depots at Chelsea, Mass., Galveston, Tex., Detroit, Mich., and Ketchikan, Alaska; on aids in the Hudson, St. Johns, Detroit, Mississippi, and St. Marys Rivers; the Eastern Shore of Chesapeake Bay, and at light stations at Point Jiguero, P. R., the Florida Reefs, Fairport and Conneaut Harbors, Ohio, Indiana Harbor, Ind., and Point Vincente, Calif.

SUMMARY OF MORE URGENT NEEDS OF THE LIGHTHOUSE SERVICE.

1. Revision of pay schedules is urgently needed so as to bring about a just relation according to duties and responsibilities between the various employments in this Service, and in comparison with other Government and outside employment, and to take account of the depreciated purchasing power of the dollar; most of the readjustments of pay that it has been possible to make under the appropriations have not met the needs, and certain classes, particularly the Bureau force in Washington, have shared little or not at all in advances since conditions before the war. The decreases in the cost of living that have occurred do not materially relieve the difficulty, and will not so long as the salaries above referred to are very much less than those paid in other branches of the Government for similar services.

2. Provision is urgently needed for replacing many of the vessels of the Lighthouse Service which have been lost or worn out in service or which will soon have to be condemned, as well as for adding reasonable vessel equipment to meet the considerable increase of the past 10 years in the aids to navigation maintained. The provision recently made covers only a small proportion of the needs of the Service in this respect.

3. Provision is greatly needed for improved depot facilities in several of the districts, particularly at or near Norfolk, Va.; Key West, Fla.; Honolulu, Hawaii; and Newport, R. I.; and additional funds are needed for the completion of the important depots at Boston, Mass., and Charleston, S. C., Detroit, Mich., San Juan, P. R., and Ketchikan, Alaska.

4. Legislation is greatly needed extending the retirement system in the Lighthouse Service to cases of disability incident to the work other than injury received in the line of duty, already provided for.

5. Legislation is important to better define the relations of the Lighthouse Service to the Navy under the act of August 29, 1916, providing for its transfer in time of national emergency, and to provide a proper military status for the personnel of the Lighthouse Service subject to such transfer.

More complete explanations of these and other recommendations are given in the following statements:

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 small 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 inexperience, 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 many who do enter it. The proportion of trained and efficient personnel has diminished to a serious extent during recent years.

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. There are at the present time very great and unjust inequalities in the scale of compensation, and certain portions of the personnel of the Lighthouse Service particularly suffer in this respect. Legislation is especially needed for the readjustment of statutory salaries. The fact that Congress has directly and indirectly through lump-sum appropriations provided in recent years much more liberal pay schedules for new organizations, has made substantial increases in pay for the military services, and has extended these to several services with civil duties but subject to transfer to the Navy in time of war, as is the Lighthouse Service under the laws enacted, has greatly increased the difficulty of operating the Lighthouse Service with its inadequate and unadjusted salary scales. At present officers in the Lighthouse Service charged with important responsibilities are in some cases receiving less than half the compensation of persons in other services in similar status and with no greater responsibilities or requirements.

PROVISIONS FOR RETIREMENT FOR DISABILITY AND OTHER CHANGES IN LIGHTHOUSE SERVICE RETIREMENT LAW.

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 provisions 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 in the retirement law are desirable in the interest of efficient organization.

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 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 and of household effects when ordered to permanently change station, and transportation on Army transports.

INCREASE OF RATION ALLOWANCE OR OF COMPENSATION FOR LIGHT KEEPERS.

The commutation of ration allowance authorized by the act of June 20, 1918, at 45 cents per day, is 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, or other provisions made for increase of their compensation. Although a number of the provisions recommended above would be of benefit to light keepers under certain conditions, and they have had some increase of pay and bonus in recent years, the average pay authorized by law of $840 per annum, even with bonus, rations, and quarters, when provided, is very small under present living conditions and is not commensurate with the service or qualifications required.

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 dam-

aged 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 should also be made available for repair of aids.

VESSELS, URGENT NEED FOR REPLACEMENT.

The annual report for 1919 (and the report of the Secretary of Commerce for the same year, Appendix A), gave a full statement of the 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 duty of the two types of vessels, tenders for buoy work and supply purposes, and light vessels for floating lighthouses, was explained, as well as the severe usage and hazardous service to which these vessels are exposed. These conditions still continue.

The useful life of a lighthouse tender is about 25 years, and of a light vessel about 30 years under normal conditions. The average age of the tenders is at present 21 years, and of the light vessels 30 years. Of the light vessels now in use 23 are more than 30 years old, and of the tenders 19 are more than 25 years old; 12 of the light vessels are over 50 years old. Since 1910, and particularly since the beginning of war conditions, there has been a considerable deficiency in the building of vessels sufficient to keep up this vessel equipment, aside from taking care of the large increase of about 40 per cent in the number of aids to navigation maintained. Some classes of the improved aids, particularly buoys and shore beacons, with automatic gas lights, have materially increased the work of the tenders.

A number of the older tenders are not designed to handle the modern types of heavy buoys and some of them are not sufficiently seaworthy to be sent on outside work. Many of the lightships are not in condition to be safely placed on exposed stations. The cost of repairs and overhaul becomes so heavy that it is not economical to keep in commission vessels after they have reached a reasonable limit of usefulness. The effect of continuing the use of these old vessels is often a greatly diminished output of work with the same or greater cost of operation and upkeep. Of more importance than the question of efficient and economical operation, however, is that of safeguarding life. Both lighthouse tenders and lightships are engaged on hazardous duty, and their officers and crews should not be required to serve on vessels which have passed a reasonable limit of usefulness, nor can the Lighthouse Service properly perform its part in the safeguarding of life and property on the navigable waters of this country without necessary vessel equipment.

The deficiency of vessels for the Lighthouse Service has been accentuated by a number of casualties in recent years, including losses

by submarine, ice, fire, and collision, and also by the severe usage to which a number of tenders were put while cooperating with the Navy during the recent war. Since the statement in the report of 1919 it has also been necessary to put out of commission and sell three light vessels and one tender.

Very thorough investigation has been made as to the possibility of obtaining vessels suitable for work of the Lighthouse Service from the Shipping Board or from vessels no longer needed by the Navy on account of the cessation of the war. It was found that the Shipping Board had no vessels in any way suitable. From the Navy several small vessels have been transferred which will be used for shoal water tender work, but they will be of but limited usefulness. Lighthouse tenders and light vessels are both vessels of unusual requirements, and it is impracticable to meet the special needs of this work by adapting vessels of other types. Investigation of the possibility of getting vessels from other departments is still continuing.

Congress, by the act of June 5, 1920, after full hearings, authorized a building program for vessels for the Lighthouse Service of $5,000,000, and an appropriation of $1,000,000 of this amount was made in the act of March 4, 1921. Under this and previous appropriations the following vessels included in the list of 1919 are now under construction; on the last contract much lower bids were received than for a number of years, and this appears to be a favorable time for vessel construction:

Light vessels to replace *No. 71*, Diamond Shoal; *No. 51*, relief, third district; *No. 43*, relief, eighth district; *No. 20*, Cross Rip; *No. 3*, Handkerchief, Mass.; and for Barnegat, N. J.; tenders to replace *Jessamine*, fifth district, and *Gardenia*, third district; also the plans for the tender *Goldenrod* are in preparation.

From careful estimates and examinations as to the condition and further serviceability of vessels of the Lighthouse Service it is found that, in addition to those provided for by vessels now building, 16 light vessels and 11 tenders, should be replaced within the next five years. As it will require from two to three years after appropriation is made before vessels are available for service, funds should be provided now for 15 of these vessels, being those more urgently needed, as shown in the following list:

ADDITIONAL VESSELS FOR WHICH APPROPRIATION IS NOW NECESSARY.

Tender to replace *John Rodgers*, third district, class B	$310,000
Tender to replace *Holly*, fifth district, class B	310,000
Tender to replace *Mistletoe*, third district, class B	310,000
Two small tenders to replace *Myrtle*, third district, at $100,000	200,000
Tender to replace *Arbutus*, fifth district, class B	310,000
Light vessel to replace *No. 55*, Lansing Shoal, Mich., class 3	150,000

Light vessel to replace *No. 5*, Stonehorse Shoal, Mass., class 2	$310,000
Light vessel to replace *No. 4*, relief, second district, class 2	310,000
Light vessel to replace *No. 2*, relief, fifth district, class 2	310,000
Light vessel to replace *No. 46*, Tail of Horseshoe, Va., fifth district, class 2	310,000
Light vessel to replace *No. 11*, Scotland, N. J., third district, class 2	310,000
Light vessel to replace *No. 57*, Grays Reef, Mich., twelfth district, class 3	150,000
Light vessel to replace *No. 56*, North Manitou, Mich., twelfth district, class 3	150,000
Light vessel to replace *No. 60*, Eleven Foot, Mich., twelfth district, class 3	150,000

GENERAL TYPES OF VESSELS PROPOSED.

Vessels.	Length (feet).	Construction weight.		Estimated cost.
		Tons.	Cost. per ton.	
LIGHT VESSELS.				
Class 1, most exposed stations	147	615	$396	$244,000
Class 2, exposed stations	135	530	396	210,000
Class 3, Great Lakes stations	96	240	621	150,000
TENDERS.				
Class A, seagoing	190	1,000	521	521,000
Class B, coastwise	170	595	521	310,000
Class special, inland rivers	150	250	500	125,000

AIDS TO NAVIGATION.

During the fiscal year there was a net increase of only 30 in the total number of aids to navigation maintained by the Lighthouse Service, this being the smallest increase in a number of years, due to the large number of aids discontinued. There was a net decrease of 49 lights, and an increase of 47 gas buoys, 5 float lights, and 27 unlighted aids. The total number of aids to navigation in commission June 30, 1921, was 16,356, including 5,756 lights of all classes and 593 fog signals (not including sounding buoys).

During the year 22 new aids were established in Alaska, including 11 lights, 3 gas and bell buoys, 1 gas and whistling buoy, and 7 other aids. The total number of aids to navigation in Alaska at the end of the fiscal year was 548, being a net increase of 13 over that of the preceding fiscal year.

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 35 stations, including 3 light vessels; incandescent oil vapor lights were substituted for less efficient illumi-

nant at 2 stations; and acetylene or electric incandescent illuminant was substituted for other illuminants at 71 stations, including 1 light vessel and 8 lighted buoys. New fog signals were established at 9 stations and the fog-signal apparatus at 3 stations improved by the substitution of more efficient apparatus.

ADMINISTRATION.

The general organization of the Service remained unchanged during the fiscal year.

The appropriations for the maintenance of the Lighthouse Service for the fiscal year 1922 are $1,711,250 less than the estimates submitted, and $466,000 less than the total maintenance appropriations for the preceding fiscal year, 1921. Notwithstanding that there have been reductions in the costs of a number of supplies, and also in some wage scales affecting this Service, it is doubtful whether the Service can be adequately maintained during the year on the funds available without placing aids or vessels out of commission.

There has been a marked improvement in the matter of maintaining an adequate personnel on the vessels of the Lighthouse Service, due to the passing of war conditions. At the end of the year a system of longevity increase of pay, after six months' service, for the unappointed members of the crews of Lighthouse Service vessels, was introduced for the first time, going into effect on July 1, 1921. It is believed this will have an important effect in maintaining a more efficient personnel on these vessels in the future. A system of longevity pay increase after five years' service was put into effect as respects the lighthouse keepers November 1, 1918, and has been of benefit.

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

A simple cost-keeping system was continued during the year, giving the cost of the various activities of the Service and of the principal units.

ENGINEERING AND CONSTRUCTION.

The more important items of construction completed during the fiscal year were the improvements at Woods Hole Lighthouse Depot, Mass.; Hunts Point Light and Fog-Signal Station, New York; restoring and improving the light station at Execution Rocks, New York; the erection of a plate shop and coal pocket at General Lighthouse Depot, Tompkinsville, N. Y.; improving aids to navigation, East River, New York; the establishment of an unattended light and fog signal at Bowlers Rock, Va.; the reestablishment of Choptank

River Light Station, Md.; the final completion of aids to navigation, Atchafalaya Entrance Channel, La.; the establishment of Point Borinquen Light Station, P. R., on a new site; improvements to aids to navigation and new dwelling at Guantanamo Bay, Cuba; a new keepers' dwelling, Port San Juan, P. R.; the establishment of a system of aids to navigaiton in Keweenaw Waterway, Mich.; and a system of aids to navigation in Fighting Island Channel, Mich.

Other important works in progress at the close of the fiscal year included the following: New lighthouse depot at Chelsea, Mass.; improving aids to navigation in Hudson River, N. Y.; a light and fog-signal station at Great Salt Pond, R. I.; improving and establishing new aids, St. Johns River, Fla.; improving and establishing new aids on Florida Reefs, Fla.; improvement of aids on Mississippi River below New Orleans, La.; new fog signal for Galveston Jetty Light Station, Tex.; new tower and dwelling, Point Jiguero, P. R.; improvements to aids to navigation at Conneaut Harbor and Fairport Harbor, Ohio; lighthouse depot, sixteenth lighthouse district; aids to navigation, Alaska.

In restoring aids damaged by hurricane in the Gulf of Mexico and by ice and storm on the Atlantic coast, from which this Service has suffered severely in recent years, more permanent materials of construction have been used and types of structures designed and adopted, so far as available funds permitted, with a view to greater permanency, efficiency, and economy of future maintenance.

IMPROVEMENTS IN APPARATUS AND EQUIPMENT.

Besides the radio fog-signal installations described above, other improvements have been made as follows:

Radio equipment was installed on 3 light vessels and on 1 tender during the fiscal year. At the end of the year 45 light vessels and 28 tenders were equipped with radio apparatus.

Improvements of intercoastal communication by the installation of telephones at light stations were continued during the year by the Coast Guard. On June 30, 1921, 280 light stations had telephone connections.

An automatic aerial fog bell, having a striking mechanism, similar to those already in operation at two stations in the fifth lighthouse district, was installed at Bowlers Rock, Rappahannock River, Va.

Arrangements have been made with the Navy Department for the installation of radio telephones at Scotch Cap and Cape Sarichef Light Stations, southwestern Alaska, which will be installed this present summer. Owing to the isolation of these stations communication with them by radio should prove very valuable. The eleventh lighthouse district is also taking measures for wireless-telephone apparatus at isolated stations.

The new tall type metal cone buoy, designed to replace wooden buoys used in shoal-water channels, has proved efficient and 50 have been placed in service in the third lighthouse district. Three larger buoys of this type are now being built for test.

With the growth of commercial and other electric generating plants and the extension of reliable electric current to the neighborhood of light stations, there has been an increasing use of electricity during the year for lamps in lenses and for fog-signal purposes.

A design for a gong buoy, to give a sound distinctive from the bell buoy, is under way.

Experiments and tests were continued during the year with various devices and equipment used in lighthouse work, resulting in improvements and opening up new lines of investigation; a fog-signal testing station has been completed at Execution Rocks, N. Y., and improvements in the supply and storage of cheaper grades of kerosene at fog-signal stations are being made.

PERSONNEL.

On June 30, 1921, there were 5,922 persons employed in the Lighthouse Service, including 93 technical, 155 clerical, and 5,674 connected with light stations, vessels, and depots. This is a decrease of 80 from the last annual report. This Service is charged with the maintenance of aids to navigation along 49,012 statute miles of coast line and river channel.

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 125 occasions. Many of these acts were especially meritorious and the employees were individually commended by the Secretary of Commerce.

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 have been put in use during the fiscal year, 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 at the end of the fiscal year, but the amount will be insufficient to complete the depot.

Under the allotment of $175,000, in August, 1918, from funds for national security and defense, a new plate and boiler shop, a new shed

for the storage of iron bars and shapes, and a new coal pocket have been completed.

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 the efficient operation of the vessels is much hampered in consequence. The inadequacy of space for storing and handling buoys also causes much delay and loss. Increased facilities for this depot are urgently necessary.

TENDERS AND LIGHT VESSELS.

The tenders of the Service have been in operation throughout the year, except one which was laid up a part of the year because of lack of funds. There are 55 tenders in commission, and they have steamed a total of about 465,000 nautical miles in their work of maintaining buoyage, carrying supplies and construction materials to stations, supplying light vessels with coal, water, etc., also transporting officers and employees to stations or on inspection duty; also duty in cooperating with other Government services and saving of life and property, when the occasion required.

Two tenders, the *Oak* and *Hawthorn*, are being constructed to replace the condemned tender *Gardenia* and the nearly worn-out tender *Jessamine*. The new tenders are nearly completed.

Plans and specifications are being prepared for the construction of a tender for the fourteenth district to replace the tender *Goldenrod*, which is practically worn out.

A small tender, the *Aster*, is being built for use along the intercoastal waterways of Texas and Louisiana.

Two new light vessels were completed during the fiscal year and assigned to the Great Lakes. Another new light vessel, authorized by act of November 4, 1919, is in course of construction and is nearly 50 per cent completed. This vessel is to be moored on Diamond Shoal, N. C., to replace the vessel sunk by a German submarine in August, 1918. Five new light vessels of the second class were contracted for shortly after the end of the fiscal year.

At the close of the fiscal year 62 light vessels were in commission.

Appendix G.—ABSTRACT OF REPORT OF THE DIRECTOR OF THE COAST AND GEODETIC SURVEY.

(E. Lester Jones, *Director.*)

NEEDS OF THE BUREAU.

A most important matter to be brought to your attention is the condition of the Bureau as a functioning organization. It is not up to the maximum of production, due primarily to inadequate salaries throughout the service. Congress did prevent complete disintegration of the Bureau when it gave recognition to the field officers, and their pay is now fairly commensurate with the duties performed, but there are other highly technical as well as nontechnical employees of the Bureau who have been retained only through the hope and continued promises of reclassification that have been held out to them; but now the technical employees and others that are highly qualified, though not members of the technical force, are openly signifying their intentions of leaving the Bureau to become identified with other branches of the Government service or to enter outside employment where the salaries are more commensurate with their ability and the character of work actually performed by them. This will be a loss to the country, to the Bureau, and to the individual, because the Bureau has a field of its own not paralleled anywhere else in this country, and consequently the employee leaving can not fully apply anywhere else the skill he has attained in the Bureau, nor can he be replaced by another employee of mature skill and judgment in carrying on the work of the Bureau. It was only the zeal, painstaking care, and extra efforts of these seasoned employees, imbued with the old-time tradition that the Bureau should set the standard of scientific exactness, that prevented the disintegration which would mean the loss of fidelity of our nautical charts, tide tables, current, magnetic, and triangulation data. It may be of interest to state that many of these underpaid technical employees, as well as those of the less technical workers, are compelled to resort to outside work under the most trying conditions in connection with their regular duties in order to make a livelihood. I can not emphasize too strongly that unless this fundamental trouble is soon corrected a disintegration of the service

will continue, with disastrous results of which the Government and the public will feel the effect for years to come.

Another phase of the salary question is important enough to bring to your attention, reiterating what has been said in former reports concerning this Bureau. It involves the entrance salaries, which are too low to attract those who have the basic education required for the specific work involved. Instead of being in a position to accept only those who meet the necessary requirements, the Bureau has to take men with inferior qualifications and hold them simply as "temporaries." If they show special aptitude for the work their sojourn in the Bureau is of short duration, for the present rate of pay is too small to hold them. They are benefited by the help and coaching of more experienced men, and then leave for more lucrative positions. The balance of these temporary employees who do not improve or measure up to a fair standard eventually must be dropped; and so it goes on, year after year, with an annual turnover of 50 to 100 per cent. This method of doing business is wasteful from every point of view. Until the long-recommended change for equitable salaries is made, just so long will this uneconomical condition exist.

NEW BUILDING REQUIRED.

Another serious condition that prevents this Bureau functioning to the fullest extent, and which I have dwelt on at length in previous reports, is the utterly inadequate space in which it is housed and a lack of proper and sanitary quarters.

The Bureau is operating in eight buildings, five larger and three smaller, all but two more or less detached and connected as far as it is feasible by communicating bridges. Two of the main buildings were designed and built for dwellings and one of them was used for that purpose. One of the smaller buildings was built for and used as a stable, and another two of the main buildings were designed and constructed for use as a hotel and were rented to the Government for the use of this Bureau from 1871 to 1891, when they were sold to the Government to house part of this Bureau.

As the work of the Bureau centers largely in the construction and production of nautical charts, and it is therefore a manufactory, the Bureau operates under a single handicap in buildings so little suited to its needs. It is a matter of economy to provide a respectable building for this service—it is a waste to continue under existing conditions.

ADDITIONAL SURVEY VESSELS NEEDED.

In the annual reports of this Department for recent years, and particularly in the annual report for 1920, the urgent need for

speeding up the survey of Alaska was discussed in considerable length. This condition of lack of adequate surveys to meet the requirements of commerce through Alaskan waters still exists, and since the development of that vast territory is steadily increasing, the lack of surveys must, of necessity, become more critical each succeeding year, unless funds for equipment, in excess of anything that has been provided heretofore, are made available for greater surveying activities.

The Coast and Geodetic Survey has been steadily engaged upon the survey of these waters, except during the two years that this country was at war. Careful consideration has been given to increasing the efficiency of these parties with the result that each party is now turning out the maximum possible amount of work consistent with its equipment. Consequently, we can not expect to reduce annually the unsurveyed areas in any greater proportion than we are now doing. The only solution of the problem, therefore, appears to be the assignment of more surveying parties to Alaska. This means more survey ships and launches.

Upon the termination of hostilities with the Central Powers the Department made a careful canvass of the Government's floating equipment to determine what vessels and launches could be transferred to the Coast and Geodetic Survey. As a result of this canvass, seven steam vessels and eight power launches were transferred from the Navy Department. These were all yachts or small pleasure craft that had been commandeered by the Navy for military purposes and were no longer required by that department.

These vessels were taken over by this Department reluctantly because they were far from ideal surveying vessels, but with the hope that they would, in a measure, temporarily meet the needs of the Coast and Geodetic Survey until they could be replaced by suitable vessels. Three of the larger vessels and two of the launches were returned within a few months, when it was found that no use whatever could be made of them. The others are now operating with surveying parties. They are far from efficient, but still are better than none. These vessels just about replace the old floating equipment of the Bureau which had worn out in service and was ready for condemnation at the outbreak of the war.

If the Coast and Geodetic Survey is to speed up its surveying operations in Alaska to meet the increasing needs of commerce there, it is absolutely necessary that several new vessels designed and built for the purpose be provided, and until these are obtained the present deplorable lack of surveys will continue and will become even worse each succeeding year.

There are no vessels anywhere in the Government service which can be spared from their present use to supplement the Coast and Geo-

detic Survey fleet. They are, of course, miscellaneous assortments of discarded vessels in other services of the Government such as the Navy and the Emergency Fleet Corporation, but these vessels are either so large that they can not be operated efficiently on surveying work, or are so old and worn out that the cost of putting them in operating condition would approximate the cost of building new vessels.

It has been found that a vessel of 1,000 tons displacement is large enough for all requirements of hydrographic surveying. Consequently, when it is realized that the cost of operating a vessel increases rapidly with the size of the vessel, it will be seen that to utilize a vessel of several thousand tons displacement, where a 1,000-ton vessel is sufficient, is bad business and would not be tolerated in any commercial enterprise.

The Bureau now has only 11 surveying vessels between 100 and 1,000 tons displacement and two under 100 tons, two of which belong to the Philippine Government. Three only of these vessels can work in exposed localities and the others must be employed only where shelter can be had during stormy weather. Seven of these vessels, large and small, are considered really efficient for the work on which they can be employed, and the others are only makeshifts. This is the equipment with which the Bureau must keep up-to-date surveys of the Atlantic, Gulf, and Pacific coasts of the United States and extend the hydrography out to the edge of the continental shelf; survey Alaska, Porto Rico, Virgin Islands, Hawaii, and the Philippines, and make such special surveys as may be requested by other bureaus of the Government.

NEED FOR TIDAL AND CURRENT WORK.

The Bureau is charged with making the tidal and current observations along the coast of the United States. It has a personnel trained in this particular line and its work is duplicated in no way by any other organization. The annual tide tables hase been brought to a standard which may be considered sufficient, ranking well with the published tables of any other nation. The Bureau has for many years, however, been handicapped by insufficient funds to carry out even a modest program of work for the determination of current velocities. And this is a vital factor in the safety of coastwise navigation.

The Survey has made use of every available means for securing observations for the study of current conditions along the coasts. By cooperation with the Lighthouse Service current observations have been obtained at a minimum cost on the light vessels of both coasts. This has been a big step toward safeguarding the coastwise commerce, but the observations thus obtained fulfill only in part the

need in order to reach conclusive results, and give the navigator sufficient information to keep his vessel offshore in thick weather, because of the fact that the light vessels are so widely distributed, particularly along the Pacific coast where current conditions are most complicated. An increase in the appropriation by a modest amount only would permit of securing short series of observations between the light vessels, linking together the observations made at the vessels, and permitting the Coast and Geodetic Survey to issue current predictions for the whole coast of inestimable value to the navigator. This would mean a vast saving, both in lives and property, by decreasing the number of wrecks in coastal waters, caused by an insufficient knowledge of coastal current conditions.

The port of New York, the contemplated development of which will make it by far the greatest harbor in the world, is greatly in need of systematic tidal and current survey, both for the use of the mariner, by furnishing more accurate current predictions for the docking of large vessels, and also for the engineers charged with the development of the harbor. A beginning has been made, so far as funds would permit, by the securing of current observations scattered over the harbor, but the complicated problem, due to the fact that the harbor is made up of a bay, a tidal river, and two straits connecting independent tidal bodies, makes necessary *simultaneous* current observations over the area before conclusive results can possibly be reached.

Engineers, both civil and military, as well as the mariner, are looking to the Coast and Geodetic Survey, as a tidal authority, for the solving of the intricate problems involved. The present status of appropriation for tidal and current work will not permit such a study.

OCEAN SURVEYS.

Another subject that should receive early attention by this Bureau is ocean surveys. From 1845 until 1860 the Coast and Geodetic Survey, then known as the Coast Survey, employed one or more vessels almost continuously on deep-sea hydrography in the Atlantic Ocean contiguous to our coast and principally along the Gulf Stream. This work was interrupted between 1860 and 1867, but was then resumed and was carried forward with only short interruptions until 1890. Since that time this Bureau has made only minor contributions to our previous knowledge of the deep waters off our shores and through which all our shipping, except the coastwise, must pass. The earlier work was performed mostly from sailing vessels and with such crude apparatus that incomplete and often contradictory results were obtained. The later work, particulary that of Mitchell, Sigsbee, Bartlett, and Pillsbury, was excellent but was, of course,

limited in detail to the capacity of the instruments that had been devised up to their time. This work, however, was confined to the Atlantic Ocean, Gulf of Mexico, and the Caribbean Sea, and principally to an exploration of the Gulf Stream; it was discontinued, not because sufficient information had been obtained or any of the large problems of oceanography had been solved, but because vessels were no longer available for this work, and also to carry on inshore surveying, the demand for which had been insistent. Consequently, investigations in oceanography had to give way to hydrography that was more urgently needed then by our merchant marine.

Since the war there has developed a very urgent demand for more exact information concerning the oceans, and in particular the Atlantic and Pacific. This demand comes from scientists, as well as from mariners, fishermen, and cartographers, and the information sought concerns the advancement and welfare of the country in many respects. There would result from a better knowledge of the oceans direct savings from a decreased loss of ships, their passengers and cargoes; from shorter and quicker passages; and from reduced passenger, freight, and insurance rates, because of the greater safety. There would result a better knowledge of the present fishing banks; the discovery of new fishing banks; and a better knowledge of the distribution and movement of food fishes and of their food, which would have enormous economic value to the country. A better knowledge of the configuration of the ocean bottoms, of the materials deposited upon those bottoms, and of the ocean currents may result in discoveries that will materially modify our ideas of some of the laws of nature. Meteorology is believed to be closely related to ocean conditions, and it seems more than probable that systematic observation of meteorological data over the oceans will contribute to more complete and more dependable weather forecasts.

Ocean surveys should be resumed in the Atlantic for the purpose of supplementing and extending our earlier surveys. Unexplored areas off our coast should be examined and a sufficient number of soundings taken to give at least a general knowledge of the relief of the bottom. Where the earlier surveys are known to have been made with crude apparatus and by doubtful methods, a reexamination should be made to verify the earlier work, and, if found to be appreciably in error, these areas should be resurveyed. Accompanying the hydrography there should be taken a sufficient number of observations of current, density, temperature, and salinity, to permit a thorough study of the ocean currents. These are the phases of oceanography that come properly within the scope of activities of this Bureau, but there appears to be no reason why other investigations in oceanography could not be conducted at the same time at small

additional cost by scientists detailed to the party from bureaus having cognizance of such subjects.

In the Pacific the same lines of investigation should be carried out, but there even a beginning has hardly been made; the areas of totally unexplored ocean are of vast dimensions. There is reason to believe that fishing banks of which we have no reliable information may lie just outside our coastal waters; the supposed locations of these banks should be investigated without delay. Off the southern California coast and also westward from the Hawaiian Islands are dangerous reefs in the track of our shipping. Until these and other uncertain areas are thoroughly explored we may expect unavoidable wrecks and loss of life.

GEODETIC WORK.

The geodetic control work of the Coast and Geodetic Survey has suffered in the past from lack of appreciation by the public of the actual money value of such surveys and because it was not clearly understood that it is necessary for such control surveys to precede any accurate topographic survey and mapping. These conditions have changed, for now there is a strong demand for maps which meet the most exacting requirements of the map user.

Years ago the charts of the Atlantic, Gulf, and Pacific coasts were brought into proper relation with each other by precise triangulation extending from Maine to the Gulf and from New Jersey to California, and from southern California to Puget Sound. Other precise arcs of triangulation have since been run, and now our charts of the United States waters need geodetic surveys in coastal areas only. The surveys made by other organizations in the interior of the country, however, depend upon the further extension of precise triangulation into the intermediate areas between the main arcs of triangulation.

It has been the experience of the Governments of all others of the well-organized nations of the world that accurate maps are essential to their commercial and economic development. Their mapping is in most cases further advanced than ours. When they start mapping in any part of their area they have the framework in the form of triangulation upon which to base the detailed surveys. For many years we have followed the opposite plan in this country. Various surveys and maps by Government and private agencies have been made ahead of the fundamental control with the result that very much confusion exists in these surveys and maps. This confusion should be remedied by the rapid completion of the fundamental control surveys of the country. It will then be possible to harmonize the existing surveys and maps to a great extent; and starting points,

whose latitude and longitude are known, will be available for the surveys and maps of those areas not already covered.

What has been said above with regard to the triangulation applies equally to the precise leveling of our country which furnishes accurate and final elevations to all engineers who must have this knowledge for their operations.

The cost of accurate surveying and mapping by the Government organizations should not be charged as running expenses, but rather as an investment, to assist the industries of the country in peace and to serve for a vital foundation for the operations of war. There is scarcely an industry which would not be benefited to a marked degree by the completion of the topographic surveys and maps of our areas.

The Coast and Geodetic Survey has developed efficient methods for carrying on the precise control surveys, and the other Government organizations needing control data now look to this Bureau for it. There is no duplication at present in making these control surveys, but owing to lack of funds it has been impossible to meet all demands.

GEODETIC WORK IN ALASKA.

The demands upon the Coast and Geodetic Survey for control surveys in the United States have been so great and urgent that no funds have been available for work in the interior of Alaska. This condition should be remedied at an early date. Precise geographic positions and elevations should be determined throughout those parts of Alaska where surveying and mapping are being carried on by the United States Geological Survey, the Forest Service, and the General Land Office. The development of Alaska will be much advanced by adequate maps showing the location and configuration of its surface and the fundamental control surveys should precede the detailed mapping work.

GEOPHYSICAL INVESTIGATIONS.

As an incident to the geodetic work of the Coast and Geodetic Survey, much data have been collected and discussed which has resulted in the extension of our knowledge of the physics of the earth's crust. This is of benefit to the geologist, mining engineer, and others who are interested in processes which form and modify the outer portions of the earth.

As a preliminary step, it is necessary to have detailed precise triangulation and levels in regions of seismic activity, in order that studies may be made of gradual distortions or displacements in the earth's crust prior to shock, the character and extent of the displace-

ments at the time of the earthquake, and the extent of the later readjustments of the portions displaced.

This work of the Bureau must be continued, and should be expanded to cover accurate measurements to detect the extent and rate of movements, both horizontally and vertically, of the earth's surface in regions of seismic or earthquake activity. Much time is given this important geophysical problem by other organizations, and a small sum should be made available to the Coast and Geodetic Survey in order that it may assist States and private institutions engaged in research work in the science of seismology.

It is desirable that an earth-tide station be established in the Hawaiian Islands in order that work done in this country by private institutions may be supplemented.

The cost of carrying on the geophysical research by the Coast and Geodetic Survey is very small, but the benefits to be derived therefrom by private institutions and individuals working in this important field are very great. The facilities for doing certain phases of the work are available only in the Coast and Geodetic Survey.

MAGNETIC OBSERVATIONS.

A building for office and quarters at the Cheltenham Observatory is much needed. The space now used for office work is the central portion of a building of which the wings are used for absolute observations, and there is always danger that the results may be affected by the presence in this office of magnetic material. Cheltenham is the only one of the magnetic observatories not provided with quarters for the observer. There are only two houses available for rental and they are some distance from the observatory, and conditions might at any time arise which would make it necessary for the observer to go still farther away for quarters. The maintenance of the instruments in continuous operation and the protection of the building and equipment make it important that the observer should live on the observatory grounds.

The establishment of a magnetic observatory in the Canal Zone or the island of Guam has been recommended in previous reports. It is hoped that provision will be made for this important project in the appropriation for the fiscal year 1923.

PUBLICATIONS.

The act of Congress of August 23, 1912, transferred the issue of practically all Government publications to the Superintendent of Documents. This was in the interest of economy in that it centered the distribution of public documents from one storehouse. Immediately after this law went into effect it was recognized that the

coast pilots issued by the Coast and Geodetic Survey, due to the necessity of continual revision and corrections, from information available only at the Coast and Geodetic Survey, could not be distributed by the Superintendent of Documents. Under an informal understanding, the issue of coast pilots and tide tables (the necessary accompaniments of the charts prepared and printed by the Coast and Geodetic Survey) was continued by the Coast and Geodetic Survey.

At present the buoy lists and light lists published by the Bureau of Lighthouses are issued by the Superintendent of Documents, and pilot rules are issued by the Steamboat-Inspection Service. A navigator must come to the Coast and Geodetic Survey for his charts, coast pilots, and tide tables and must go to the Superintendent of Documents for buoy and light lists and to the Steamboat-Inspection Service for pilot rules.

The handling by these three separate agencies of publications that are necessary to the mariner causes a great deal of confusion to the public and much delay. The Bureau of Lighthouses informally approached the Coast and Geodetic Survey some three years ago with the suggestion that the Coast and Geodetic Survey distribute the buoy lists and light lists published by that Bureau, foreseeing that if these publications were issued by the Superintendent of Documents and the other publications needed by mariners were issued by the Coast and Geodetic Survey, the confusion and delay mentioned above would ensue. For some reason the arrangement was not carried into effect.

It is recommended in the interest of efficient service to the public that legislation be enacted authorizing the Coast and Geodetic Survey to distribute the coast pilots and tide tables prepared by that Bureau, as well as the buoy lists and light lists published by the Bureau of Lighthouses and the pilot rules published by the Steamboat-Inspection Service.

GENERAL STATEMENT OF WORK DONE.

A detailed statement of work done will be found in the complete report of the Director. In general, hydrographic work has been forwarded on the Atlantic coast and several hitherto uncharted portions of the coast have been surveyed. Numbers of radical changes in conditions were found both above and below water and these have been surveyed and charted.

Hydrographic work has also been undertaken on the Pacific coast. The steamer *Natoma* was engaged in making a resurvey of Los Angeles Harbor and its approach from July to December. This was required to chart the numerous changes which have occurred in recent years. Continuous improvements, including large expenditures

for a breakwater, dredged channels, and docks, have had the effect of transforming an anchorage with few natural advantages into a harbor having unusual facilities. Based on this resurvey the chart will represent the harbor in an adequate manner.

The steamer *Natoma* returned to San Francisco in January and resumed work in that locality. The two principal areas examined were the bar at the entrance of the harbor and the southern arm of the bay.

HYDROGRAPHIC WORK, ALASKA.

In previous reports the conditions of the surveys in southern Alaska have been described in detail. They are so fragmentary and incomplete that much remains to be done before charts up to modern standards can be issued. These conditions are now being cured by supplementing the scant hydrography and topography, and also by the execution of the triangulation for primary control. Three parties have continued the program of last year and each party is organized to carry on simultaneously several branches of work.

HYDROGRAPHIC WORK, PHILIPPINE ISLANDS.

Work in the Philippine Islands continued during the first half of the year with four ships in commission. Shortage in available field officers, however, only permitted continuous operation of two ships, while the remaining two were divested of officers during repairs. In January, one ship was returned to the Philippine Government, but the remaining three were on active duty during the second half of the year.

On October 3, a disastrous fire destroyed the entire upper portion of the Intendencia Building in Manila, in which the office of the Coast and Geodetic Survey is located on the ground floor. The heavy stone foundation walls and reinforced concrete ceilings over a portion of the office afforded a fireproof section to which employees and volunteers transferred all records and sheets. The Survey fortunately suffered no loss except that of water damage to furniture. The building is being reconstructed in fireproof manner throughout.

A new building to house a chart-printing plant has been completed. Machinery for photolithography and employees for its operation are now arriving and it is hoped in the near future to begin publication of Philippine charts at Manila.

COAST PILOTS.

The coast pilots are in effect companions to our charts, since they contain a great deal of detailed information of importance to navigators for which there is no room on the charts.

A certain class of information contained in the coast pilots is compiled from various sources, but the directions and descriptions on which the actual navigation of a vessel depends are written from personal knowledge obtained on the spot. To obtain this first-hand information during the past year, Porto Rico was visited and the examination extended to the Virgin Islands. A revision in the field was also made along the coast of the South Atlantic States from Georgetown, S. C., to Key West, Fla.

AERIAL PHOTOTOPOGRAPHY.

The Mississippi River Delta was photographed by the Air Service of the Navy during March, April, and May, 1921, for the use of this service in revising the chart of this area. Office work on these photographs is now in progress.

Atlantic City, N. J., and the vicinity was photographed in July, 1919, by the Air Services of the Army and Navy, and almost the whole of the outer coast line of New Jersey was photographed in March, 1920, by the Army Air Service. Revised charts of the New Jersey coast are now being compiled and will soon be issued, showing corrections as obtained from these photographs. An officer of this service established the ground control and verified the results of the office compilation, making an examination of the photographic mosaics in the field.

The results of this work have produced some interesting conclusions in regard to chart revisions.

Owing to lack of trained personnel, the Air Services were not able to carry out a program of photographing portions of the Atlantic coast as requested by this Bureau for the purpose of chart revision.

GEODETIC WORK, TRIANGULATION, TRAVERSE AND BASE MEASUREMENT.

The geodetic work of the Coast and Geodetic Survey, during the fiscal year 1921, was for the primary purpose of furnishing geographic positions and elevations to the engineers of the Coast and Geodetic Survey and to those Government, State, and city organizations which use such data. This is the major function of the geodetic work of the Bureau, and a systematic plan is in progress for extending horizontal and vertical control into all the areas of the United States and into Alaska, in order that final positions and elevations may be available for all surveying, mapping, and other engineering activities.

ASTRONOMIC WORK.

Astronomic latitudes and longitudes were determined by two observers along the arc of precise triangulation from El Reno, Okla., to the vicinity of Williams, Ariz. The principal duty of this astro-

nomic party was to determine differences of longitude but, as an incident to this work and without additional cost, astronomic latitudes were also determined.

Azimuth observations were made as usual by the precise triangulation and the precise traverse parties as the work progressed.

PRECISE LEVELING.

A line of precise levels was extended from the vicinity of Klamath Falls to Ontario, Oreg., by a double precise-level party using automobile trucks as a means of transportation. This line of precise levels was connected at Klamath Falls and Ontario with previously established bench marks. A spur line was extended from the vicinity of Burns on the main line of levels westward to Bend, Oreg. This leveling was requested by the United States Forest Service and the United States Geological Survey, and the elevations determined will be of special value to both organizations.

TIDES AND CURRENTS.

The growing importance of tidal and current work of the Coast and Geodetic Survey rendered advisable the creation of the division of tides and currents out of the section of that name on December 15, 1920.

The purpose of tidal observations is to furnish the data necessary (*a*) in the publication of charts, coast pilots, and tide tables; (*b*) in precise leveling, harbor construction, and coast protection; and (*c*) in general engineering and other technical and scientific work.

During the year principal tidal stations were maintained as follows: Seven on the Atlantic coast, three on the Gulf coast, and six on the Pacific coast. The computation for these stations was kept up to date by the Washington office.

Tide tables are issued annually, in advance for the purpose of furnishing the Navy and merchant marine with the predicted times and heights of every high and low water for a calendar year at the principal ports of the world, and appear in three forms: General Tide Tables, containing the predicted tides for 81 principal ports covering the entire maritime world, together with tidal data for 3,500 secondary ports; Atlantic Coast Tide Tables, a reprint of that part of the General Tide Tables covering the Atlantic coast of North America; and Pacific Coast Tide Tables, likewise a reprint from the General Tide Tables covering the Pacific coast of North America.

MAGNETIC WORK.

The magnetic observatories at Cheltenham, Md.; Vieques, P. R.; Tucson, Ariz.; Sitka, Alaska; and near Honolulu, Hawaii, have been

in operation throughout the year and continuous records have been secured on the magnetographs and seismographs. The necessary absolute observations and scale value determinations have also been made.

Improvements have been made to the buildings and grounds at the Honolulu Observatory, and repairs to the office building at Vieques were in progress at the end of the fiscal year. Local conditions in the building trades made it necessary to postpone longer the erection of a building for office and quarters at Cheltenham, but it is hoped that this most important work can be done next year.

Because of the inability to secure additional magnetic observers it was necessary to suspend almost entirely the field work of the magnetic survey, and as a consequence the preparation of the isogonic chart for 1920 had to be postponed. A single magnetic observer began field work the middle of June and had occupied three repeat stations at the end of the fiscal year.

PUBLICATIONS.

In the realization that there are funds of information and data resulting from the surveys made by the Coast and Geodetic Survey that are useful to civil engineers, surveyors, and others, a medium was sought for bringing these facts to the attention of those to whom they would be of use. The means adopted was the printing for each State in the Union a very small pamphlet containing an index of the counties in each State, showing exactly the kind of surveys and places in each county where surveys have been made and the publications of the Coast and Geodetic Survey containing the results. That this effort is appreciated is attested by many letters from civil engineers and others.

By the close of the fiscal year, such pamphlets had been printed and distributed for the following States: Colorado, Iowa, Illinois, Kansas, Minnesota, Missouri, Montana, and Nebraska.

A publication entitled "Elements of map projection with applications to map and chart construction" (Special Publication No. 68) was prepared during the year. As a result of certain problems encountered by cartographers and engineers in connection with their activities during the recent war, there has been a marked quickening of interest in the subject of map projections, with particular reference to the types best adapted to various mapping projects. The extent to which the Bureau has been called upon for advice and assistance on these projects has led it to conclude that there exists the need for a fuller and more comprehensive presentation of the subject than has hitherto been available anywhere.

The present publication is the result of this conclusion. It is a comprehensive treatment of all the more useful projections, present-

ing them in as simple a form as possible in their general characteristics, mathematical development, and actual construction. It is designed to enable the map maker to choose the projection best adapted to the particular project in which he is interested, and to furnish him the data necessary for its construction.

Special Publication No. 67, "Latitude developments connected with geodesy and geography, with tables, including a table for Lambert equal-area meridional projection," expresses the difference between the geodetic latitude and each of the other four classes of latitude in a series of the sines of multiple arcs. It contains also a number of tables of value to geodesy and map making.

Another publication issued during the year is Special Publication No. 75, "Radio-compass bearings." Since radio-compass bearings are being used more and more extensively for fixing positions at sea, it was thought necessary to investigate the methods of plotting them, both conveniently and accurately, upon the charts in general use. The two projections considered in the publication are the Mercator projection and the gnomonic projection. A number of other publications dealing with the results of the Bureau's activities were issued during the year.

HOUSING INTERNATIONAL BOUNDARY COMMISSION IN BUREAU BUILDINGS.

On February 28, 1921, the Director of the Bureau was made International Boundary Commissioner. The personnel and equipment of that commission were at that time housed in rented quarters, the yearly rental being $2,688. The rented quarters were released April 1, 1921, and the commission was comfortably settled in a portion of the buildings occupied by the Bureau, and as the commission had formerly been practically a part of the Bureau, the change proved to be a convenience as well as an economy, because many of the records are used in common, and because the Bureau has facilities in the way of photographic laboratories, instrument shop, and carpenter shop, etc., that are taken advantage of by the commission at a cost to the Government far less than if such services were performed by a commercial house.

The work of refinishing the rooms and halls of the buildings occupied by the Coast and Geodetic Survey has progressed satisfactorily, and the portion of the buildings thus renovated presents a pleasing and sanitary appearance. However, it must be borne in mind that this is a temporary expedient only, in the interest of sanitation of the old buildings occupied by the Bureau, for the highest degree of efficiency can never be attained by a Bureau that is a manufacturer of charts, instruments, etc., in buildings constructed for use as a hotel and dwelling house.

Appendix H.—ABSTRACT OF REPORT OF THE COMMISSIONER OF THE BUREAU OF NAVIGATION.

(DAVID B. CARSON, *Commissioner.*)

American shipping registered for the foreign trade and enrolled and licensed for the coasting trade, including the fisheries, on June 30, 1921, comprised 28,500 vessels of 18,350,000 gross tons compared with 28,183 vessels of 16,324,024 gross tons on June 30, 1920. The year's increase in round numbers is 2,000,000 gross tons compared with 3,400,000 gross tons for the previous year, and as the Shipping Board's building program will soon be completed, the increase in tonnage for the current fiscal year will be much smaller; indeed, if the wooden ships built under war contracts are stricken from the register and broken up, our total tonnage at the end of the year will not materially change from the present figure.

A brief analysis of our shipping on June 30, 1917, just as the United States entered the war and at the close of the fiscal year June 30, 1921, may help to define the present situation. American shipping falls naturally into three divisions, first, seagoing ships of 500 gross tons or over by which practically all our foreign trade and nearly all our coasting trade by sea are carried on; second, shipping on the Great Lakes; and finally, the large number of small vessels employed mainly on rivers, bays, and sounds connected with the oceans.

The following table presents the analysis:

June 30—	Grand total.		Seagoing.				Great Lakes.		All others.	
			Shipping Board (over 1,000 gross tons).		Private owners (over 500 gross tons).					
	No.	*Gross tons.*	*No.*	*Gross tons.*	*No.*	*Gross tons.*	*No.*	*Gross tons.*	*No.*	*Gross tons.*
1921	28,500	18,350,000	1,798	7,993,771	1,925	5,240,630	2,900	2,620,000	21,877	2,495,599
1917	26,397	8,871,037	19	76,160	1,552	3,564,160	3,001	2,779,087	21,825	2,451,630
Increase	2,103	9,478,963	1,779	7,917,611	373	1,676,470	−101	−159,087	52	43,969

The tonnage of the Great Lakes is less than four years ago, and the tonnage on rivers, bays, and sounds connecting with the ocean and of smaller vessels is practically unchanged. The tonnage of

both these divisions is under the protection afforded by the reservation of the coasting trade to American ships and it is bound to resume its normal increase with the restoration of normal conditions in industry, mining, and agriculture throughout the country; indeed, projects are already under way for the construction of larger ships on the Great Lakes than those with which their commerce was conducted before the war.

Up to the autumn of 1920, the increase in our larger seagoing ships was chiefly in the foreign trade, but from the end of November, 1920, to June 30, 1921, the increase of such ships in the coasting trade amounted to over 600,000 gross tons in the foreign trade to only 350,000 gross tons, while during June alone the coasting trade increased 170,000 gross tons, the foreign trade decreased 80,000 tons. So far from discouraging, these indications point to a return to normal conditions under which for many years our vessels in the coasting trade steadily increased in total tonnage and in the average size of ocean steamers and improved type until when we entered the war in 1917 they, with our contract mail steamships, supplied virtually all the American tonnage engaged in transporting our troops and supplies throughout that year and continued up to the armistice in 1918 to perform a share in that transportation equal to that performed by a small portion of our fleet actually built under Government war contracts and in operation up to that date. There are no structural reasons why the better types of ocean carriers employed in the longer voyages of our coasting trade may not be employed in many branches of the foreign trade. The reasons they were not so employed before 1914 were almost wholly financial, because the ships cost more to build and more to operate than the ships under foreign flags with which they must compete, and those conditions are now reasserting themselves.

INSPECTION OF CARGO STEAMERS.

In the table above are included 2,752 seagoing ocean steamers of 1,000 gross tons or over and aggregating 12,115,751 gross tons. Of these only 238 of 1,271,179 gross tons are passenger steamers. Over 90 per cent, accordingly, of the number and nearly 90 per cent of the tonnage with which most of our foreign trade and the larger part of our coasting trade by sea are conducted are ocean cargo steamers. In 1914 the number of American cargo steamers in overseas trades was trifling and up to our entry into the war in 1917 it was small, although coasting trade steamers in considerable numbers had been diverted by high freight rates to the foreign trade.

Within four years, accordingly, the fleet of American ocean cargo steamers has grown from a moderate tonnage, adequate only for our

coasting trade, to a tonnage approximating, at least on paper, the corresponding ocean cargo fleet under the British flag. The figures just given include the wooden cargo steamers built under war contract which are being disposed of as fast as possible and will soon disappear from our tonnage records. For economic reasons most of the smaller steel steamers built on the Great Lakes for ocean trade are not adaptable to competitive foreign trades in times of peace and the supply of them exceeds current coasting trade requirements.

Before the war the cost of building ocean steel cargo steamers was so much less in the United Kingdom than in the United States that American capital seeking investment in ships in the foreign trade resorted to foreign shipyards for the construction of its ships and to foreign registry and flags for their operation. The difference in initial cost is vital because in the form of interest, insurance, and depreciation it must be carried all through the life of the ship and these items aggregate annually a considerably larger sum than the entire pay roll of officers and crew and the cost of their subsistence. The difference in the first cost of our cargo ships built under war contracts and of foreign ships with which they enter into competition is even greater now than was that difference before 1914. The S. S. *Mauretania*, the fastest and one of the largest British trans-Atlantic mail and passenger ships, costs less per gross ton to build than most of our cargo steamers, including the wooden ships, built under war contracts. Competition would be impossible were not the remedy for the situation at hand in the powers bestowed upon the Shipping Board by the merchant marine act, 1920, or by a modification of that act. The war cost of the cargo ships was far above their value for foreign trade in these days, but it can be reduced to an amount at which competition will be feasible, so far as that difference in the form of interest, insurance, and depreciation are fixed factors in shipping competition.

A proper step toward securing more equal terms of competition between American and British ocean cargo steamers as well as a step toward promoting American commerce was taken in section 26 of the merchant marine act, 1920, by which cargo steamers were allowed to carry a small number of passengers without complying with all the requirements imposed on passenger steamers. For many years the British law has regarded no British ship as a passenger ship unless it carried more than 12 passengers and only such ships are subject to annual survey or inspection. The treatment of ocean cargo steamers under American and British law is based on two quite different applications of the principle that Government should take necessary precautions to secure first the safety of those on board, then of the cargo representing the country's commerce, and finally, reasonably equal terms of competition, so far as Government may

deal with this last-named subject. Such safety depends first on the structure of the hull of the ship and on its machinery; second, on the depth to which the ship can be loaded with safety according to its voyage; third, the lifeboats and other life-saving equipment, for use in event of collision, fire, or other casualty, including of late years wireless apparatus; and fourth, the qualifications and numbers of the officers and crew required to navigate the ship. Under ordinary conditions the structure of a carefully and skillfully built ship does not change appreciably for several years, while some of the officers and more of the crew are likely to change with every voyage and the life-saving equipment must be replenished or renewed at somewhat frequent intervals.

Marine insurance antedates by centuries the active concern of Governments with the elements of safety in navigation just recited, and to merchant shipping and trade by sea compliance with its requirements is as essential as compliance with the requirements of Governments. To meet these requirements the great ship classification societies were established during the last century, of which the British Lloyds' Register is the oldest and most widely known, and the reorganized American Bureau of Shipping the recognized institution of the United States. These classification societies maintain corps of trained naval architects, marine engineers, and surveyors to establish technical rules of construction, to see that they are complied with during the building of the ship and by survey after a casualty to determine the necessary repairs to restore seaworthiness, or from time to time to make surveys in view of depreciation. Upon the classification of a ship by one of these societies the rate of insurance of the ship depends in large measure, and this is equally true of American and British ocean cargo steamers as well as of those under other flags.

The difference between the American and the British application of the principle that the State should concern itself with the safety of the ocean cargo steamer lies in the fact that, so far as the construction of the hull and machinery is concerned, the United Kingdom relies mainly on compliance with the rules of Lloyds' or the British Corporation or other recognized classification societies whose surveyors superintend the construction of the ships. On the other hand, the Government of the United States requires annual inspection by Federal inspectors, although the American shipowner, like the British or Norwegian, is in large measure dependent for his marine insurance upon the classification of his ship by the American Bureau of Shipping, Lloyds' Register, or the Norske Veritas, as the case may be.

It is no disparagement to worthy men in the Steamboat-Inspection Service to state that they do not have, as a rule, the technical knowledge required to frame rules for construction of hulls, nor do they

have the time, in view of other work, to supervise the actual application of the rules during the building of ships, and the salaries paid and appropriations voted are insufficient to secure the number and kind of men required. The owner of the American cargo steamer, accordingly, is subject to regulation by the classification society, corresponding to the British shipowner's regulation, and in addition to the annual inspections of the Steamboat-Inspection Service. The Federal Government, to be sure, makes no money charge for this inspection, but occurring at fixed dates every year the annual inspection (except on the Great Lakes where the close of navigation by ice changes conditions somewhat) can not fail frequently to withdraw a ship for a time from profitable occupation. It may be said in explanation of the dual system of hull inspection in the United States that until recently there was no American classification society recognized as competent to perform for American shipping the services performed for British shipping by Lloyds' Society, but it is hard to see how such a society could have been established and maintained while the Government was maintaining its own system of inspection.

It would tend to create more even conditions of competition in foreign trade if these two systems of hull inspection should not continue to run parallel. My predecessor seems to have taken the same view in recommending that the Steamboat-Inspection Service be intrusted with the work of classification of ships, which would involve a large increase in the number of the personnel and considerably higher technical attainments, and would end the American classification society. Much might be said for this recommendation if the American merchant marine were to continue under Government ownership and operation. The aim, however, is to restore our merchant shipping to private ownership and operation as rapidly as possible, and every private instrumentality needed for the successful operation of such a merchant marine should be developed. The recasting of our inspection laws along these lines in order to secure more even conditions of international competition is recommended.

LOAD LINE.

While we have a dual system for the inspection of the hulls of ocean cargo steamers, we have no statutory regulation whatever of the load which such steamers can carry with safety, though for obvious reason such regulation for many years has been in force on British, Norwegian, and other foreign ships and a law upon the subject was passed this year by the Japanese Parliament. In ports of these nations, accordingly, American ships must be marked with load lines according to the load-line law of the port, all of which, however, are based on British freeboard tables and agree substan-

tially with British law. The structure and dimensions of the hull of the cargo steamer, of course, determine generally the amount of cargo it can carry safely, though this varies somewhat with the season of the year and the waters to be traversed. The marking of load lines, accordingy, is intrusted to the classification societies, subject to approval of Government authorities. To meet the embarrassments caused to American shipping by the lack of load-line legislation, an informal arrangement was made in 1919 with the authorities of the United Kingdom by which load lines marked by the American Bureau of Shipping according to British freeboard tables and rules are recognized temporarily. This arrangement, of course, can not be maintained indefinitely, and the enactment of a load-line law, which the growth of our fleet of ocean cargo steamers in foreign trade made necessary two years ago, is again recommended and, indeed, is essential to the modification of the inspection system just outlined. The enactment of the load-line bill will require the creation of a small technical staff in the Department.

OCEAN PASSENGER STEAMERS.

One of the most valuable results of the International Conference on Safety of Life at Sea, held in London in 1913–14, following the loss of the S. S. *Titanic*, was an agreement among maritime nations on the general rules which should govern the subdivision of hulls of ocean passenger steamers, carrying often several thousand passengers. The Senate of the United States ratified the international convention but with a reservation which has delayed the proclamation of the convention and its transmission. In the meantime Great Britain, France, and other Powers ratified it and have taken preliminary steps toward its execution. Some modifications of the proposed rules concerning subdivision of hulls of passenger ships have been found desirable in view of the experience gained from the terrible loss of life through the sinking of many passenger ships by submarine warfare, directed particularly against such ships and subjecting their hulls to every form of strain through the explosion of torpedoes. Informal conversations on desirable changes in the rules framed in 1913–14 have been held, and preparation should be made for participation by the United States in the final discussion of the rules and for their administration in this country, because the possession of a large merchant fleet by the United States entails responsibilities, for the discharge of which we are thus far provided with inadequate administrative personnel.

The faster ocean passenger steamers carry the mails and are adaptable to service as troop transports or auxiliary cruisers, and the war showed how indispensable they are to a maritime nation.

For these services to Government, actual or prospective, most of them under foreign flags operate under mail subsidy contracts with their respective Governments. The merchant marine act, 1920, in sections 7 and 24 authorized such contracts with American ocean passenger steamship lines, subject only to the amount of the appropriations which Congress may see fit to vote for these essentially national purposes.

RADIO COMMUNICATION.

The regulation of radio communication has become a matter of increasing intricacy and difficulty owing to the rapid development of the art during the war and since its close and to new purposes to which it is being applied. Our own legislation of 1910 and 1912 and the international radiotelegraph convention of 1912 were framed almost entirely for the purpose of securing radiotelegraphic communication with the least practicable interference between ships at sea and the coast, or between ships at sea with one another. The legislation and the international convention have been reasonably successful in accomplishing that purpose, but both, especially the convention, contain technical restraints, proper enough at the time, but now rendered obsolete by recent scientific developments and improvements in methods and apparatus. Of even greater present interest, however, is the development of radio communication across the ocean between continents by high-powered stations, and the increasing use of wireless communication between stations on the land, where it is supplementing the communication hitherto maintained by telegraph and telephone wires. The radio telephone must be recognized as an established fact, though yet in its infancy.

The only justification for Federal regulation of radio communication lies in the fact that no such communication at all would be possible unless some authority determined the power and wave lengths to be employed by different stations and classes of stations in order to prevent mutual interference with the transmission and reception of messages. Invention has already done much to reduce such interference and will doubtless do more, but interference is still the important factor to be considered from the point of view of the practical use to-day of this indispensable means of communication.

For obvious reasons the basic regulation of radio communication must be international, and for this and other reasons the Department has not urged consideration of a bill submitted to Congress early in the summer to bring the act of 1912 to regulate radio communication more into accord with present requirements. The preliminary conference at Washington on electrical communications, attended in the autumn of 1920 by representatives of the United States,

Great Britain, France, Italy, and Japan, prepared the draft of an international convention on electrical communication by telegraph, telephone, and radio, and the portions relative to radio communication have been under review during the summer by an international technical committee, the American membership of which included competent representatives of the Department. The preliminary work for the revision of the international regulation of radio communication is thus fairly well in hand. It may be best, therefore, to await the submission to the Senate of the revised international convention before considering the bill to change our own laws, although that bill was drawn so as to be readily adaptable in administration to the changes probable in the convention. If, however, a convention shall be submitted and ratified, bringing our telegraph and telephone systems, as well as radio communication, within international regulations, a change in the method of administration in this country will be necessary. The Department of Commerce, as the department administering shipping laws generally, was naturally charged with the administration of the radio legislation of 1910 and 1912 through the Bureau of Navigation. Its radio inspection service is confined to the seaboard and the Great Lakes for which the small annual appropriation, $80,000, scantily provides. As already pointed out, the present development of radio communication is over the land or between distant continents. A force of inland inspectors must soon be provided in any event, and if the United States is also to exercise any measure of supervision under international rules over telegraphs and telephones, all necessary regulation of electrical communications could properly be administered by the Post Office Department which is already represented even in remote hamlets.

The act of June 24, 1910, requiring wireless apparatus and operators on all ships carrying 50 or more persons has been adopted in substance by all the principal maritime nations and the amendment in 1912 to that act, requiring a continuous wireless watch, was incorporated in the International Convention for Safety of Life at Sea of 1914.

The British law of 1912 requires all ships of 1,600 gross tons or over to be equipped with wireless apparatus and operators. Nearly all such American ships not already subject to the act of 1910 are owned by the Shipping Board, which voluntarily equips them with wireless apparatus and operators, so that there is no immediate need of considering an amendment in this respect of the act of 1910. The continuous watch under the American law is maintained by two licensed operators; under the British law by one licensed operator and two watchers, trained to receive elementary signals and messages but not skilled in sending them. Our own system is preferable.

SHIPPING COMMISSIONERS.

During the year 650,840 officers and men have been shipped, reshipped, and discharged, including repeated shipments and discharges by shipping commissioners, compared with 628,890 for the previous fiscal year and 378,772 for the year 1914. Collectors of customs, acting as shipping commissioners at ports where these officers are not established, shipped and discharged during the year 56,366 officers and men compared with 63,426 during the previous year.

The duties of deputy shipping commissioners require their presence on board American ships to sign on and pay off crews when ships are about to depart or have just arrived. Ships' movements are not always determined by office hours, and to save considerable expenses their convenience must be consulted. The pay possible to deputy commissioners, under parsimonious appropriations allowed, has been quite inadequate and the practice has grown of accepting gratuities for services, which is subversive of discipline. In consequence considerable changes in the service have been necessary. The conditions which led to them can be permanently and satisfactorily remedied, however, only by appropriations sufficient to insure salaries to this service which will enable the men to live and support their families. The estimates of appropriations for the shipping commissioners and their deputies for next year have been appreciably increased for this reason.

Of 321,235 officers and men shipped before shipping commissioners, 123,622 were native Americans and 32,049 naturalized Americans, in all 155,671, or a trifle over 48 per cent, compared with 50 per cent the previous year. For 10 years before the outbreak of the war the proportion of Americans shipped by shipping commissioners annually ranged from 47 to 49 per cent, and from 1915 to 1918 it fell to an average of 43 per cent, in 1919 it was 47.6 per cent, and in 1920 it was 50.5 per cent. The provision of the seamen's law which requires 65 per cent of the deck crew of cargo steamers, which make up the bulk of our merchant fleet, to be able seamen of three years' experience on deck at sea is a discouragement to young Americans desiring to follow the sea, and that period of time is not, in fact, required to qualify a young man to perform all the duties imposed on men in the deck department of modern ocean cargo steamers. Other maritime nations do not impose such a requirement on their cargo carriers, except Norway, which requires a trifle over 50 per cent of the deck crews of cargo carriers to be men of three years' service, and with its great seafaring population, for generations employed on shipboard, this requirement is, in fact, no such handicap as the requirement of 65 per cent on crews shipped in the United States.

ENFORCEMENT OF THE NAVIGATION LAWS.

During the fiscal year 1921 the various services of the Bureau reported 10,707 violations of the navigation laws. The violations of the various laws affecting motor boats and the rules of the road have increased from 5,722 to 7,448. This increase is due to a considerable extent to the increased activities of the Department's five inspection vessels. There is a decrease from 2,650 to 1,090 in the number of violations of the steamboat-inspection laws reported to the Department.

The attempts of the Department to enforce the law in regard to the documenting of yachts, securing the surrender of licenses of vessels on expiration, preventing the transportation of automobiles with the fires not extinguished and the motors running, preventing the overcrowding of passenger steamers, and preventing foreign vessels from engaging in the American fisheries, have emphasized the necessity for providing and adjusting penalties for violation of the laws covering these important subjects having to do with safety to life and property.

During the fiscal year 1921 the navigation and customs officers in the case of 11,106 trips of excursion steamers counted 5,141,099 passengers, an excess of nearly 400,000 over the previous year. The navigation inspectors made 8,960 counts of 3,224,232 passengers. The importance of this check on the loading of passenger vessels is shown by the fact that on 370 occasions it was necessary to prevent additional passengers from going on board as the limit of safety had been reached. The vessels which were thus prevented from overcrowding carried 263,570 passengers.

During the year there was a material increase in the number of vessels bringing steerage passengers to the United States, the entries of such vessels increasing from 664 to 844, the number of steerage passengers brought increasing from 296,066 to 586,195 passengers. During 1919 there were but 314 entries of such vessels, with 55,603 passengers; during 1918, 442 entries, with 67,988 passengers; and in 1917, 630 entries, carrying 147,493 steerage passengers.

The act of June 7, 1918, requiring that motor boats shall be numbered in the same manner that automobiles are numbered and for similar purposes has resulted up to June 30 last in the numbering of 141,006 motor boats on the navigable waters of the United States. This does not include any motor boats on the small inland lakes. Reports from the inspecting officers and other sources indicate that the law is being fairly well complied with and is resulting in material benefit in the enforcement of laws, both Federal and local, and in the collection by the Internal Revenue Bureau of taxes on this form of navigation.

MOTOR BOATS.

During the fiscal year 1921 the five inspection vessels of the Department continued the work of enforcing the navigation laws and the collection of internal-revenue taxes on pleasure boats and water transportation. During that period these vessels made 2,955 inspections of vessels, noted 4,400 of such vessels as being in violation of law, and reported 1,257 as having failed to pay internal-revenue taxes. These vessels made a fairly complete inspection of the Atlantic and Gulf coasts and a portion of the Mississippi River and tributaries. The revenue collected from fines and taxes was in excess of the cost of the service. The total amount of the internal-revenue taxes collected it is not possible to state inasmuch as no money is collected by the officers of this Department, the failure to pay the taxes being reported to the internal-revenue collectors for action.

NAVIGATION RECEIPTS.

The three main sources of Federal revenue from navigation yielded during the year ended June 30, 1921, a total of $2,497,946.81, compared with $1,998,287.79 during the previous year. Tonnage duties, navigation fees, and navigation fines are collected by collectors of customs in the administration of laws by general direction of the Secretary of Commerce through the Bureau of Navigation. The receipts during the past fiscal year, compared with the receipts during the last prewar year ended June 30, 1917, were as follows:

June 30—	Tonnage duties.	Navigation fees.	Navigation fines.	Total.
1921	$2,208,539.69	$225,822.89	$63,584.23	$2,497,946.81
1917	1,393,743.16	159,808.03	49,962.37	1,603,513.56
Increase	814,796.53	66,014.86	13,621.86	894,433.25

The receipts from tonnage duties the past year were the largest recorded and will probably be less during the current year.

NAVIGATION APPROPRIATIONS.

The appropriations for the Bureau for the past fiscal year, compared with those for the year ended June 30, 1917, were as follows:

June 30—	Bureau.	Shipping Service.	Tonnage adjustment.	Counting passengers.	Navigation laws.	Wireless laws.	Total.
1921	$42,530	$115,200	$3,760	$18,250	$75,400	$60,000	$315,140
1917	37,780	74,425	3,000	18,250	26,500	45,000	204,955
Increase	4,750	40,775	760	.....	48,900	15,000	110,185

The principal increase is in the amount appropriated to enforce the navigation laws through the patrol boats and is due to employment of three additional boats released by the Navy Department after the war to the Department of Commerce, which has permitted the extension of the service to the Mississippi River and Gulf of Mexico and made more effective the inspections on the Atlantic coast. The next largest increase is for the shipping commissioners and deputies, 36 per cent, while the clearances of American ships in overseas trades, a fair measure of the increase of work involved, have increased from 3,000,000 tons in 1917 to 11,000,000 tons during the past fiscal year. The increase in the appropriation for the wireless service has been 33 per cent; in 1917 there were 836 American ships equipped with radio apparatus and 160 land stations, while in 1921–22 there were 2,978 American ships with wireless apparatus and 491 land stations, the increase in the number of operators licensed for the stations having kept pace with the increase in the number of stations. Since 1917 the work of adjusting and revising tonnage measurements has increased by the range of questions raised by the Shipping Board's construction and changes in construction of the fleet.

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Appendix I.—ABSTRACT OF REPORT OF THE SUPERVISING INSPECTOR GENERAL OF THE STEAMBOAT-INSPECTION SERVICE.

(GEORGE UHLER, *Supervising Inspector General.*)

ORGANIZATION.

The following positions were embraced in the Steamboat-Inspection Service at the close of business on June 30, 1921:

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	11	
Messenger	1	
		15
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	94	
		391
Total		406

During the year one additional clerk was appointed in the Office of the Supervising Inspector General, Washington, D. C., and two positions as clerk in the office of the local inspectors at Boston, Mass., were discontinued because of the retirement of two employees in that office.

STATISTICS.

The force inspected and certificated 8,095 vessels, with a total gross tonnage of 16,231,001, of which 7,753 were domestic vessels, with a total gross tonnage of 13,139,030, and 342 were foreign passenger steam vessels, with a total gross tonnage of 3,091,971. Of the domestic vessels there were 6,437 steam vessels, 716 motor vessels, 15 passenger barges, and 585 seagoing barges. There was an increase of 44 in the total number of vessels inspected and an increase of

609,602 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 42 steam vessels, with a total gross tonnage of 1,118. There were inspected for the Government 57 hulls and 2,100 boilers. There were 2,793 reinspections of steam vessels, motor vessels, and barges.

Licenses were issued to 25,997 officers of all grades. There were examined for visual defects 8,522 applicants for license, of whom 45 were found color blind, or with other visual defects, and rejected. Certificates of service were issued to 16,949 able-seamen, and 1,316 were rejected. Certificates of efficiency were issued to 13,548 lifeboat men, and 1,726 were rejected.

Steel plates for the construction of marine boilers to the number of 4,752 were inspected at the mills, and a large amount of other boiler material was inspected. There were examined and tested 306,661 new life preservers, of which number 6,107 were rejected.

The total number of accidents resulting in loss of life was 200. The total number of lives lost was 330, of which 69 were passengers. Of the lives lost 159 were from suicide, accidental drowning, and other causes beyond the power of the Service to prevent, leaving a loss of 171 as fairly chargeable to accidents, collisions, founderings, etc. There was a decrease of 140 in the number of lives lost as compared with the previous fiscal year. Passengers to the number of 351,720,890 were carried on vessels required by law to make report of the number of passengers carried. Dividing this number by 69, the total number of passengers lost, shows that 5,097,404 passengers were carried for each passenger lost. The number of lives directly saved by means of the life-saving appliances required by law was 826.

ADMINISTRATIVE EFFICIENCY.

Never in the history of this country has there been a greater demand for efficiency than at the present time, not only in private business, but also in the Government's business. If a study be made of the history of the Government it will be found that there has been a general tendency toward centralization, and centralization is absolutely an essential factor in obtaining good administrative results, and if an examination be made of the methods of the Steamboat-Inspection Service of to-day as against those of 30 years ago it will be seen that there is now an effective central control in the office of the Supervising Inspector General.

The traveling inspectors are necessarily becoming an increasingly valuable arm of the Service, for these men, working directly under the office of the Supervising Inspector General, follow up the work of the local and assistant inspectors in the inspection of ships.

For the past several years the Service has made a careful survey of ships passing through the Sault Ste. Marie Canal to prevent overloading, and splendid results have been obtained.

In a previous annual report mention was made of the desirability of having a corps of experts in the office of the Supervising Inspector General whose business it would be to pass upon hull construction and boiler construction. This is now more desirable than ever before, as it will not only insure uniformity throughout the entire Service in the inspection of hulls and boilers but it will assist in that rapid rehabilitation and expansion of the Amercan merchant marine that is so essential at the present time.

RETRENCHMENT.

There is no subject to-day that is receiving more attention than the high cost of Government. As a result of the World War, this country now faces a tremendous financial burden that must be carried by this generation and succeeding ones, and the people necessarily look for means to be relieved. They can not be relieved of it, but it can be lightened, and the Steamboat-Inspection Service having in mind this thought has reduced its force of inspectors by 39, effective July 31, 1921. While this reduction has not occurred in the fiscal year for which this annual report is rendered, it is properly discussed now because the causes leading to the necessity for retrenchment occurred in the fiscal year ended June 30, 1921, and also in preceding ones. A careful study of the Service may result in a still further reduction, but be that as it may, the efficiency of the Service will not be impaired, as boats will be inspected just as thoroughly and just as rapidly as heretofore, and the public will be served just as satisfactorily as in the past.

MORE ADEQUATE PAY.

While it may not be in line with the general tendency toward reducing the expenditures of the Government, yet I can not refrain from pointing out the inadequte pay received by inspectors in the Service. In order to maintain the morale, and in order to improve it, it is necessary that the inspectors receive better pay. The clerks should also receive more pay, as they do work that is quite as important as the inspectors.

DESIRABLE LEGISLATION.

That which is most desirable in the matter of legislation is the placing of the supervising inspectors of steam vessels under the classified civil service. All of these men are efficient and able and are required by law to formulate rules and regulations for the inspec-

tion of vessels of the American merchant marine and for the governing of the officers and crews of those vessels. By reason of the fact that they have generally risen from the ranks, they are better able to know what they are doing when they formulate rules and regulations. There is no room for any politics in the Steamboat-Inspection Service, because it exists primarily for protecting life, and after that property. In order to keep the Service as completely as possible out of any political control or interference the supervising inspectors should be under the classified civil service.

Another matter that should receive legislative action is the amendment of sections 4418 and 4433, Revised Statutes, in regard to the working pressure and hydrostatic pressure of boilers. A bill looking to this end has been introduced in Congress, and if that bill is enacted into law it will enable the Service to make modern its rules and regulations with reference to boilers.

Legislative attention should also be given to the amendment of section 4472, Revised Statutes, in regard to the transportation of dangerous articles, because that section as at present written is obsolete. The Service should have authority not only to prohibit the transportation of dangerous articles, which is only given to a limited extent at the present time under section 4472, Revised Statutes, but also to regulate their transportation, and thereby make it possible to carry on steamers carrying passengers certain commodities that may with safety be carried but which under the law as at present are entirely prohibited.

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DEPARTMENT OF COMMERCE
UNITED STATES OF AMERICA