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TWENTY-SEVENTH

ANNUAL REPORT

OF THE

SECRETARY OF COMMERCE

FOR THE FISCAL YEAR ENDED JUNE 30

1939

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1939

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TWENTY-SEVENTH ANNUAL REPORT

OF THE

SECRETARY OF COMMERCE

DEPARTMENT OF COMMERCE,
OFFICE OF THE SECRETARY,
Washington, December 1, 1939.

TO THE CONGRESS OF THE UNITED STATES
(Through the President):

I am submitting herewith the Annual Report of the Secretary of Commerce, covering the fiscal year ended June 30, 1939.

The functions of the Department of Commerce and its activities during the fiscal year 1939 can be adequately reported only against the background of our economic experience. The past fiscal year brought to a close the most significant decade in the economic history of the United States, and it is in terms of the developments characterizing that decade that this Department's functions must be considered.

THE DECADE 1929–39

This 10-year period opened at a time of unparalleled prosperity in the United States, at a time when the disruptions of the early postwar years seemed to lie definitely behind us and a vista of ever expanding national well-being ahead. Within a few months, however, the stock market collapsed, and the prospect of ever-rising activity disappeared as deflation set in and the great depression began.

During the early years of the decade, no decisive attempt was made to use the powers of government to stop the deflation or to correct the underlying conditions. It was generally assumed that if "automatic" economic forces were permitted to take their course, the deflation would come to a "natural" end and the way would be cleared for a return to prosperity.

Persistence in this view of the economy and the policies of government which it implied brought us by 1933 to the brink of economic paralysis. Unemployment increased steadily and reached a total far exceeding the proportions of any previous depression. As the financial structure crumbled, banks failed, mortgages on homes and farms were foreclosed, and millions of thrifty folk lost their life savings. Trade dwindled and factories closed. Local governments were caught between mounting tax delinquency and rising requirements for relief. Between 1929 and 1932, the national income declined by more than 50 percent in money terms and more than 40 percent in terms of goods and services.

Similar conditions in some foreign countries resulted in the sweeping away of the existing forms of government. In this country, the

overwhelming demand that the Federal Government make full use of its powers to overcome the depression resulted in the reversal of Government policy at the very moment of final and utter collapse of the financial structure.

RECOVERY, 1933–37

A vigorous attack upon the depression was at once undertaken. The banks were reopened. Federal grants were made to the States for unemployment relief. Foreclosures on homes and farms were halted. Agricultural adjustment and industrial recovery programs were launched. The financial structure was permanently strengthened by deposit insurance, reform of the banking system, and by long overdue controls of security issuance and trading. Overnight the downward trend was reversed and marked recovery was felt in every part of the Nation.

The Federal program contained many elements that contributed to this recovery, but the fundamental factor was the increase in buying power that it turned back into the markets for industrial and agricultural products. Income payments increased in all sectors of the economy, but the paralyzing deflation had imposed caution and many preferred the greater liquidity of an enlarged cash or a reduced debt position. As a result, the receipts of business, of State and local governments, and of private individuals exceeded their disbursements. Hence it was not these sectors of the economy that gave impetus to the recovery. It was the Federal Government which, by adding more to the stream of income than it withdrew, made expansion of activity possible in spite of the excess of withdrawals in these other areas of the economy. Moreover, this excess of withdrawals constituted an important and continuing drag on the recovery movement, so that the Federal contribution to buying power, which was designed to provide only the initial impetus to expansion, had to be continued for a longer period than would otherwise have been necessary.

Despite these restrictive influences, employment and production rose until in 1937 they approached the levels attained in 1929. The national income increased from 40 billion dollars in 1932 to 72 billion dollars in 1937. Wages, salaries, profits, and property income participated in the increase. Income from farming, from mining and manufacturing, from distribution and finance all increased as activity surged forward. By 1937 the national income was within 15 percent of its 1929 level. In real terms, that is in terms of the flow of goods and services, it was only a shade below that all-time peak.

Purchases of goods by consumers, which had dropped from 51 billion dollars in 1929 to less than 29 billion dollars in 1932, recovered to 44 billion dollars in 1937. In terms of physical volume, however, the decline had been only about 20 percent and the expansion carried us to within 5 percent of the 1929 high. Sales of automobiles were again at prosperity levels, new passenger-car registrations in 1936 and 1937 being exceeded only by those in 1929. Electrical household equipment, such as refrigerators and vacuum cleaners, topped all previous highs. In short, sales of both durable and nondurable consumers' goods expanded broadly and this high level of consumption constituted the basis of the recovery.

Capital outlays of business also recovered in most lines as part of the general upward movement. In 1937 expenditures for new equipment were greater than in any previous year except 1929. Expendi-

tures for both plant and equipment in mining and manufacturing and in agriculture returned to the high levels of the prosperity years.

Investment tended to lag, however, in a few special areas. In the construction field, high prices and costs were an obstacle to expansion. In the railroad equipment industry, activity failed to recover fully, as the slow process of underreplacement had not yet brought plant and equipment facilities to a level consonant with the reduced volume of railroad traffic. The utilities found their capacity ample for the demand that could be obtained under established rate structures. State and local government preferred reduction of debt to extension of services. Investors remembered the losses of the indiscriminate foreign lending of the 20's, and international developments made foreign countries appear even less attractive as an outlet for their investable funds. In total, these fields, which failed to follow the normal pattern of recovery, did much to keep total investment at a reduced level.

Employment followed the general economic pattern of the period. After the large decline, there was recovery that approached previous peak levels. A fairly large volume of unemployment persisted through the recovery, but this represented primarily the increase in the population of working age and to a lesser extent the residual labor force left without jobs by technological improvements that reduced the number of workers required to produce a given output.

In 1937, the recovery gave promise of wiping out the small margins by which the various measures of economic activity fell short of their previous peaks. It also gave promise of bringing the Federal budget again into balance. The cash deficit was reduced from more than 4,000 million dollars in 1936 to less than 400 million dollars in 1937. With the continuation of recovery, even this small excess outlay would have disappeared.

THE RECESSION OF 1937–38

Just at that moment, however, there ensued the sharpest decline on record. In 5 months, from August to January, the rate of industrial production plunged over 30 percent, and business activity was back at the levels of 3 years earlier. What was responsible for this relapse?

This sharp decline in economic activity appears to have been the outgrowth of a number of factors. From early 1934 until the final quarter of 1936, the Government program yielded a recovery that was both broad and balanced, with prices and costs remaining virtually at a constant level. In the last quarter of 1936, however, a number of dislocations began to develop. Following the bulge in Federal income-creating disbursements that resulted from prepayment of the adjusted service certificates, production and sales moved sharply upward. Prices edged toward higher levels. Certain raw material prices advanced rapidly under the influence of world rearmament and the speculative factors engendered by it. Led on by the upturn in consumer demand and attempting to take advantage of or protect themselves against prospective price increases, businessmen began to expand their inventories.

Other factors also contributed to this inventory movement. In some instances, shortages threatened because of the attrition of capacity and skilled labor during the depression. In others, monopolistic condi-

tions created the prospect of higher prices rather than of larger output and capacity. In addition, the transitional difficulties arising from expanding labor organization and the attempts to resist it resulted in actual or threatened interruptions of production. So rapid was the inventory accumulation that even if businessmen had merely discontinued further accumulation, without attempting to liquidate stocks already accumulated, there would have been a substantial recession.

The rise of prices and costs, besides leading to inventory accumulation, restricted several important types of fixed capital expenditure. Residential construction is a notable example. The cost of both building materials and labor moved up substantially from 1936 levels, despite the relatively small decline in these costs during the depression. While, under the stimulus of lower financing costs and rising consumer income, building subsequently revived without a substantial decline in costs, at that time it was sharply curtailed. Contracts awarded for residential construction declined 33 percent during the year.

Early in 1937, the incentives for further accumulation of inventories began to disappear. The effects upon consumers' expenditures of the reduction in the Federal contribution to the income stream began to be felt. Retail prices in the early part of 1937 continued upward, as did the total value of sales, but the volume of goods moving through the market leveled off and began to decline. The labor difficulties were cleared up in some broad areas and the resumption of activity in these areas served for a time to conceal the vulnerable situation created by the rapid accumulation of inventories and the rise of prices and costs. Finally, however, it became clear that new orders were falling off and that inventories were excessive. The result was inevitable—production was curtailed while the excess was being sold off.

With the Federal contribution to buying power drastically curtailed, moreover, production had to fall far to reach the point at which the desired liquidation could take place. The sharp initial drop was then followed by a continuing gradual decline that again threatened a cumulative deflation such as was experienced in 1929–33. This prospect evoked a vigorous application by the Federal Government of the instruments that had proved their effectiveness before. Results were prompt and striking.

THE 1938–39 RECOVERY

The Federal contribution to buying power was steadily increased beginning in March 1938, and June saw national income on the upturn once more. W. P. A. rolls were expanded, public construction was rapidly brought to a new peak, residential construction was promoted, and payments to farmers were increased. Through the operation of these and other parts of the program, recovery was advanced strongly during the fiscal year 1939. At its close, national income payments were flowing at an annual rate of nearly 69 billion dollars, as compared to a rate of 74 billion dollars in August 1937 and of 65 billion dollars in May 1938. If allowance is made for the decline

in prices over this 2-year period, total income in terms of goods and services was again near the 1937 peak.

This recovery was in many respects similar to that of 1933–37. Directly and indirectly, Government policies resulted in outlays that reversed the trend in national income. With total income in the hands of consumers again increasing, businessmen again found their markets expanding, and the general level of activity was stepped up. This rising trend also eliminated any tendency on the part of businessmen to dispose of their inventory holdings. Thus inventories, which had been a large negative factor during the preceding year, became a neutral or perhaps even a small positive factor during the fiscal year 1939.

The Federal Reserve index of nondurable production recovered almost to its previous high, remaining closely in line with increasing sales of nondurable goods. Sales of consumers' durable goods also participated fully in the recovery. Sales of 1939 model-year automobiles were about 30 percent greater than 1938 model-year sales. Sales of ranges, refrigerators, and other appliances also showed very substantial increases. The use of installment credit for these and other items, some of which had not previously been sold on credit, meant the entrance into the market of a large volume of purchasing power that could not have been expected on the basis of current incomes alone. It is estimated that consumer credit increased during the year by one-half to 1 billion dollars. This was especially significant because it constituted a sharp reversal of trend; for in the latter part of the preceding fiscal year, consumer credit had declined by more than a billion dollars.

Construction activity also made large gains during this year. Under the stimulus of Federal Housing Administration action to reduce interest rates and ease monthly payments by home owners, residential construction rose to new postdepression highs by the end of 1938. As a result of the increases in residential and public construction, total construction rose sharply in the latter half of 1938. Contracts awarded showed an average increase in the last quarter of more than 70 percent over the corresponding period in 1937 and were maintained throughout the first half of 1939 at the highest level since 1930.

Capital expenditures and employment also followed the general trend, the restrictions on their full recovery being much the same as before. In a number of special areas, the rate of installation of new productive facilities appears to have remained at fairly low levels, and over the economy as a whole, increases in population of working age and improvements in industrial techniques increased the number of workers unable to find employment. At the close of the fiscal year, however, the trend of business activity and employment was upward.

LESSONS OF THE DECADE

From the experience of the past decade there emerge certain inescapable conclusions which are of the utmost importance for the national economic policy of both government and business. The foremost lesson of the period is that deflation generates cumulative forces which may completely shatter the productive mechanism. Once deflation dominates the economy, it creates a dozen maladjust-

ments for every one it corrects. The cumulative forces it releases undermine sound and unsound parts alike. They affect ever-widening areas of the economy, until the devastation is general and complete. To prevent these disastrous deflations is a fundamental responsibility of government. The experience of certain European countries bears evidence that unchecked deflation is the greatest threat to democracy in the modern world.

The second conclusion is that the tremendous wastes involved in continued deflation are entirely unnecessary. We have, in recent years, developed the techniques necessary to halt a deflationary process and to secure recovery. This was demonstrated in the 1933–37 recovery. The use of the same techniques to reverse the downward trend in 1938 should dispel any doubts on this score. If the instruments created within this 10-year period are used promptly and aggressively, the country need never again be subjected to the intolerable and unnecessary costs of continued deflation.

In this decade it has also been demonstrated that the complexity of our industrial economy requires great care in the use of these techniques. The sharp bulge in Federal income-creating expenditures in 1936 appears to have been a factor in the development of the dangerous inventory accumulation of that year. Again, the sharp reduction of the Federal net contribution, which came at a time when the economy was particularly vulnerable, played a part in the sharp decline of 1937–38. So powerful are these instruments of the Federal Government that their application requires the most careful and consistent adjustment to economic developments and an avoidance of abrupt modification.

Furthermore, particular attention must be given to certain dislocations which may arise in any rapid recovery, whatever its source may be. The accumulation of inventories and the dislocations in the cost-price structure in the boomlet of 1936–37 illustrate the dangers from this direction. The operation of the economy at a low level of activity entails the impairment of equipment, the depletion of stocks, and the loss of labor skills. Subsequently, under the pressure of a recovery movement, bottlenecks, speculative price and cost movements, and inventory bulges tend to develop. These developments may serve to undermine or reverse any substantial recovery movement, unless Government, business, and labor cooperate to maintain balance in the price and income structure.

AMERICA'S PROMISE: NEW FRONTIERS

A final conclusion emerges from the experience of this decade. In spite of broad recovery, we have not succeeded in making full use of our productive resources. There are some who derive from this experience the conclusion that we have reached the limit of our growth, that our economy is saturated and doomed to stagnation. I vigorously reject this view. It is true that the period of our history in which a rapidly increasing population was opening up a new continent has come to an end. We have extended our boundaries to their geographic limits, built great cities, constructed vast transportation networks, opened up our land to cultivation, and equipped our workers with effective capital larger in total amount and higher per

worker than in any other nation. But the disappearance of the geographic frontier does not mean the disappearance of the economic frontier. It is true that world markets under existing conditions of international anarchy beyond our control offer more limited opportunities for the export of our goods and our capital than once was the case. Our home market, on the other hand, is limitless. A rising standard of living can provide an indefinitely expanding market for the fruits of our expanding productive capacity. We have only begun to fulfill the unlimited promise of America.

The vast potential expansion that awaits us in this direction may be illustrated by the fact that in 1935–36 there were more than 12 million families whose incomes were below $1,000 a year. If the incomes of all these families had averaged $1,000 a year, or less than $20 a week, their annual expenditures would have been greater by about 4 billion dollars. They would have spent about 1,300 million dollars more on food alone, about 700 million dollars more on housing, about 400 million dollars more on clothing, and an equal amount more for automobiles and other forms of transportation. Expenditures on fuel, light, gas, and household furnishings would have run 600 million dollars a year higher.

To look at the problem from the point of view of prices rather than income, a vast potential market awaits further progress in the application of mass-production techniques. For example, the residential construction of the past few years has been confined primarily to houses costing over $4,000 and hence to families with incomes over $2,000. This group constitutes less than 20 percent of the total population. Nearly 25 million families have incomes of less than $2,000 a year. A reduction of construction costs to make houses available at $2,500 would tap a substantial fraction of this vast potential market. Similarly, in the field of electric power, the Tennessee Valley Authority has found that rate reductions have led within a few years to an increase of 88 percent in the consumption of electricity. If it were feasible to reduce electric rates throughout the Nation to the levels now prevailing in the Tennessee Valley region, the demand for electricity would so expand as to require an investment, in generating and transmission facilities, in wiring and appliances, of billions of dollars. Thus in these two fields alone we have a foreseeable investment frontier of tremendous dimensions awaiting the successful adaptation of modern technology to supply present needs. Additional billions of investment would be required by the industries which serve those directly involved. The release of potential consumption through lowering of costs and prices can open the floodgates of investment.

DIFFICULTY OF THE TASK

But the conquest of these new frontiers is not an easy task. On every side there exist deep-seated and long-standing arrangements to freeze prices, restrict markets, and resist technological changes. These practices and the attitudes of mind which underlie them are in part the result of the difficulties of the past decade, during which markets have been limited and the price of technological change has been unemployment; but they have themselves been a profoundly important fac-

tor in creating these difficulties. These attitudes of mind must be altered, these practices must be abandoned if we are to attain our goal of the full utilization of our resources and fulfill the promise that America offers.

It is a difficult task and one which requires the understanding cooperation of all elements of the economy—business, labor, and government. Each of these has an important share in the responsibility for the achievement of our objective as well as the promise of unprecedented rewards.

On the part of business, there is necessary a general readjustment of pricing policies to the requirements of modern mass consumption. At present many business firms operate on the basis of a "break even" point placed at a low proportion of capacity—they anticipate a low volume of sales, and set their prices to assure a profit at that level, despite the fact that such pricing policies themselves restrict sales and increase unit costs.

During our earlier history, high prices and high profit diverted employment from consumption to investment. Today high prices reduce consumption but fail to expand investment. Because the extensive fields of investment—investment first in building our Nation and then in supplying foreign nations with capital—are reduced, a policy of high prices and high profit margins at present restricts both consumption and investment and increases the already large volume of idle money and the number of idle men. Modern production techniques and full utilization of resources today demand broad markets, and such markets can be obtained only by prices which fully reflect the efficiency of these techniques.

The application of the low-price principle has been singularly effective in the automotive industry in developing mass markets and creating large-scale employment and good profits. Reference has already been made to the possibilities in the fields of low-cost housing and electric powers. The principle must be extended to other areas as well. Progress in this direction requires concerted moves by big and small businesses alike. A bold, forward-looking price policy to tap larger markets would go a long way in creating investment opportunities now lacking.

In some cases it appears to be the policy of business to seek maximum profits in the short run, whenever the situation permits, because a period is foreseen when activity will be small and profits will disappear. But this very policy serves to limit the markets and to undermine recovery. A restricted market is created when a large market is available. Government has provided business with a bottom beneath which activity will not be permitted to go, and on this basis business can adjust its pricing policies to a longer-run viewpoint.

The expansion of consumption and investment also involves appropriate wage policy on the part of business. The broad markets necessary for full employment require a high level of consumer purchasing power, and it is important that wage incomes be as high as possible. If wage payments are deficient, the basic demand for the products of farm and factory is necessarily curtailed.

The role of labor in a national program is a vital one also. The Federal Government has in recent years taken steps of historic importance to prevent the exploitation of labor and to strengthen the

economy by putting a floor under wage rates and a ceiling over hours. It has also taken measures to guarantee to labor the right of collective bargaining. Labor is now able to bargain with industry on more nearly equal terms. An enlightened democracy will never permit the abandonment of these advances.

In this strengthened position, labor as well as industry will recognize the needs and operating principles of our economic system. Wage rates which actually reduce output and employment, or restrictions which prevent technological advance, impede the expansion of consumption and investment and affect all interests adversely. In seeking to improve the condition of labor, it should be recognized that high wage rates are not always synonymous with high annual income for the workers. It is the latter which is the primary objective. Without a high standard of living for this major segment of the Nation, a sustained and expanding flow of national income cannot be achieved.

THE RESPONSIBILITY OF GOVERNMENT

Government, on its part, is charged with primary responsibility for the national welfare. It seems clear from past experience that the community must accept, finally and without qualification, the responsibility for securing and maintaining the conditions necessary for the full utilization of our resources. The contributions of business, labor, and agriculture to this end are vitally important, but the residual responsibility is of necessity borne by government. The latter must provide business and agriculture with the assurance of at least a moderately high level of buying power for their products. With such assurance, long-range plans can safely be made. It must also provide the laborer with reasonable assurance of an employed and productive future, not only because of the human values involved, but so that labor too, through its organizations, can cooperate with business and government on a basis of long-run mutual advantage. The aggressive economic expansion of the past century was nourished by the vigorous optimism of a Nation expanding its frontier and exploiting its natural resources. Today the Federal Government can restore that optimism through a guaranty that the risks of periodic breakdowns will be eliminated, that the consumers' market will expand, and that the process of intensive exploitation can be safely undertaken.

Specifically, while the Federal Government encourages private investment and employment by every means in its power, to the extent that private employment cannot be found the Government must help provide the necessary jobs and support the Nation's buying power through public action. Value given for value received is the only sound principle. The country cannot be poorer when its workers are creating useful works, and future generations will not be poorer for the receipt of this heritage.

FISCAL IMPLICATIONS

The fiscal implications of governmental responsibility for the attainment of full employment of our resources are clear. During periods when the Government is setting a bottom to a deflationary spiral and

giving impetus to recovery, an unbalanced budget necessarily develops. As recovery advances and the national income expands, however, government revenues increase, government expenditures decline, and the budget is brought into balance.

In 1936–37, within 1 year, the Federal cash deficit was reduced from more than 4,000 million to less than 400 million dollars. In view of what we now know about the situation which developed in that year, it appears that our progress toward a balanced budget may have been too rapid. This experience, however, provides convincing evidence that the budget will come into balance as we approach full employment of our productive resources.

The maintenance of that balance, once achieved, cannot be dissociated from the maintenance of a balanced economy. To keep the economy in balance at full employment will require the concerted efforts of business, agriculture, labor, and government.

The responsibilities of business and labor in adapting price and wage policies to the requirements of a full-employment economy have been set forth above. A continuing program to bring and keep agriculture in sound relationship with other sectors of the economy is likewise a requisite. The cooperative responsibility of government and agriculture in such a program is vital if a high level of national income is to be sustained.

Other government policies also must be adapted to this requirement. State and local governments, as well as the Federal Government, must shape fiscal and tax policies so as to contribute to the common objective. The tendency in recent years has been toward increasing tax pressure on low-income groups. The trend in the use of sales taxation and other similar measures which restrict consumption should be reversed. At the same time, taxation on business that can be shown to discriminate against equity financing and to impose an undue burden on risk-bearing should be adjusted. The policies of business and labor looking toward the expansion of markets must be reinforced by government policies at every point if the desired common objective is to be reached and held.

It is obvious from the experiences of the past decade that we are confronted with a serious, complex economic problem. This problem demands the calm thinking of the best minds, in and out of government, so that our system can continue flourishing in the finest democratic tradition.

THE ROLE OF THE DEPARTMENT IN ECONOMIC EXPANSION

In pursuing a joint program toward full employment, business, labor, and government require information on current business developments. The Department of Commerce has long performed the function of collecting such information. The need for an expansion of this service is imperative under the new conditions.

The need for more complete and more fully analyzed information is illustrated by the inventory situation that developed in 1937, which has been discussed above. At the time these inventories were being accumulated there was little knowledge of the true situation, but we know now that the rapid building up of inventories set the stage for the inventory liquidation that played so large a part in the ensuing recession. Business and labor had no satisfactory means of evaluat-

ing the maladjustments they encountered. The relatively few real shortages gave plausibility to the prospect of more general scarcity. Analysis was needed at that time to indicate to business and labor that the price and cost increases were choking off demand and that goods which should have been moving into consumption were being lodged in inventories. Had full information been available and its full implications explored, many of these developments, so costly to business and the country generally, might have been mitigated. Fuller knowledge would have brought moderation and placed restraint upon speculation and price expectations.

The formation of sound judgment during the period ahead by both business and government requires full information on every phase of current economic activity and careful analysis of the conditions and trends that underlie it. Developing maladjustments must be brought to light quickly, and the measures necessary to correct them must be indicated.

"PROBLEM AREAS"

Beyond these functions of information and analysis, the Department also has a responsibility to contribute toward the elimination of obstacles to expansion that exist in certain "problem areas" of the economy, where considerable parts of the business community face similar difficulties. For example, in the field of small business there exist difficulties peculiar to that part of the business community. Many small businessmen have brought their problems to the attention of the Federal Government. The Department is, of course, vitally interested in solution of these difficulties. It has cooperated and will continue to cooperate with other branches of the Government in seeking to solve problems of small businessmen.

In other areas, such as foreign trade, construction, public utilities, and railroads, there exist particular obstacles which must be overcome if the general welfare is to be promoted with full effectiveness. The Department of Commerce, being properly concerned in all matters affecting economic activity, is eager to cooperate with representatives of these industries and the Federal agencies more directly involved, in developing appropriate policies.

Another general problem of great importance has resulted from the policies of the several States in regulating the shipment of goods into or through their territories. While primary responsibility rests upon the States, the Department of Commerce must be interested because of the restrictive effect of these regulations on interstate trade. The Department plans, therefore, to take an active part in a concerted program by all interested parties to reduce such barriers to a minimum.

Because of its central position at a focal point between business and government, the Department of Commerce has responsibilities toward both. In the practical adaptation of policy to the requirements of the economic situation, both require reliable knowledge of each other's requirements. This Department has the responsibility of keeping the branches of the Government informed of business needs, so that congressional and administrative policies may be made with full knowledge of the business problems that are involved.

It is necessary always to keep in mind both the primary objective of attaining maximum economic efficiency and reasonably full em-

ployment, and the fundamental desirability for the businessman of minimizing adjustments of practical policy and the changes in operation they make necessary. Hence, the representatives of the Department of Commerce must at all times be prepared to work with both parties in any problem of policy and to assist in devising a solution that best meets all requirements.

LARGER NEEDS OF THE ECONOMY

It is not enough, however, that help and information be available to all who request it. No real solution of a problem is achieved if what is thought by one to be a solution creates a larger problem for another. It is a primary responsibility of the Department of Commerce, therefore, to be concerned that only such policies be adopted as are consistent with the larger needs of the economy, and these larger needs must in all cases be made clear to the parties involved.

In part, then, the liaison function of the Department is to contribute to the cooperative solution by business and Government of our economic problems and to provide representation for economic views which might otherwise be inadequately presented. In part it is to assist all policy makers, whether of business or Government, by indicating the significance of current and proposed policies in the light of underlying developments.

EXPANSION OF SERVICES NOW UNDER WAY

The Department has recognized its responsibilities and is taking active steps to adapt and expand its services to permit the full discharge of its functions. Reorganization of the Bureau of Foreign and Domestic Commerce aimed at improving its services to the business community was under way as the fiscal year ended. We are providing greater coverage and prompter reporting of current business information. It is necessary to extend the national income studies to provide vitally needed information on the current flow of income into investment and consumption channels. Hardly less important is the development of statistical services to fill gaps in our knowledge of inventories, new orders, plant capacity, and other important items. This work must be done for individual commodities and individual lines of business as well as for the economy as a whole.

In the highlights of the past year's work, which are discussed below, will be seen the beginnings that have already been made toward fulfilling the broader functions of the Department which have been discussed in the preceding pages. At this point I should like to call attention to the diligent work done by employees of the Department in Washington, in offices throughout the country, and in their stations around the globe. Their work during the past year is a source of gratification to persons both in and out of Government interested in the effective functioning of the Department.

HIGHLIGHTS OF THE YEAR

REORGANIZATION

During the fiscal year 1939 there were several changes in the organization structure of the Department of Commerce. The Civil

Aeronautics Act, approved June 23, 1938, established the Civil Aeronautics Authority and vested in the Authority the powers and duties relating to the promotion and development of civil aeronautics which were previously vested in the Secretary of Commerce. Upon the transfer of these functions to the Civil Aeronautics Authority under date of August 22, 1938, the Bureau of Air Commerce was abolished.

Effective July 1, 1939, under Reorganization Plan No. II, issued pursuant to the Reorganization Act of 1939, the Bureau of Lighthouses was transferred to and consolidated with the United States Coast Guard of the Treasury Department, the Bureau of Fisheries was transferred to the Department of the Interior, the Foreign Commerce Service of the Bureau of Foreign and Domestic Commerce was transferred to the Department of State, and the Inland Waterways Corporation was transferred from the War Department to the Department of Commerce. While these adjustments were not effective until the beginning of the fiscal year 1940, the necessary details incident to the transfers were accomplished prior to the close of the fiscal year 1939. There were in addition minor organization changes within the Department, designed to facilitate the administration of certain activities and to group similar services on a functional basis.

For many years there has been a definite need in the Department of Commerce for an official with the rank of Under Secretary to assist the Secretary in planning the functions and directing the many activities of the Department and to relieve him by presiding at important meetings and conferences and by consultation with business and industrial leaders. Also, the volume of work of the character which should ordinarily require the personal attention of the Secretary has increased to the extent that it has become necessary to delegate many of these duties. Accordingly, the office of Under Secretary of Commerce was established by an act of Congress approved June 5, 1939.

As the result of considerable study looking to a more proper segregation of the functions of the Bureau of Foreign and Domestic Commerce and the Bureau of the Census, the function of reporting current trade statistics was transferred from the former to the latter bureau. This transfer is in accordance with the plan to centralize in the Bureau of the Census the collection of statistics, and will permit the Bureau of Foreign and Domestic Commerce to devote its efforts more exclusively to an analysis and interpretation of these statistics.

The reasons for the consolidation of the Foreign Commerce Service with the Foreign Service of the Department of State relate to the changed character of difficulties in securing export markets. When the Foreign Commerce Service was inaugurated, foreign trade was on a relatively free basis. The appropriate role of government was to advise and assist exporters as individuals. Today the introduction by many countries of import limitations, restrictions, and quotas and of exchange controls and other national policies has created a situation where the Government's most effective aid lies in keeping open the channels of trade. This involves negotiations with foreign governments, a function necessarily performed by the State Department. Hitherto, officials of the Foreign Commerce Service have been able to participate in these negotiations only in an advisory capacity. One of the great advantages of integrating the foreign services is that

fuller use of our experts will be possible, now that all will have diplomatic status.

Under the integration plan, the actual personnel and administrative routine are transferred to the State Department, but the Department of Commerce retains control over trade-promotion work and commercial reporting of offices in foreign lands. Frequent duplication of effort will be eliminated under the new plan. Furthermore, the commercial attaché will become head of an integrated network of State Department offices covering many cities in the foreign country, whereas formerly the Foreign Commerce Service officers generally confined their activities to the cities in which they were stationed. Other favorable features of the consolidation plan are the opening of a career service to the men who are transferred and the careful training provided for new commercial attachés.

TRADE AGREEMENT PROGRAM

The outstanding accomplishment of the cooperative interdepartmental work on trade agreements since the program was initiated in 1934 took place during the past fiscal year. This was, of course, the far-reaching trade agreement with the United Kingdom and the British Crown colonies. Nearly one-fifth of our entire foreign trade is with the countries covered by this agreement. Other important agreements signed during the year were those with Canada, Ecuador, and Turkey. The latter assumes special significance because it is the first to be concluded in eastern Europe, which from the commercial standpoint has been largely under German domination. The Bureau of Foreign and Domestic Commerce cooperated extensively with the State Department in the execution of the trade agreement program.

STUDIES FOR THE TEMPORARY NATIONAL ECONOMIC COMMITTEE

The Department was extremely active during the year in making a large number of studies for the Temporary National Economic Committee. Of these one was completed during the year. This was the very important study of the patent system.

Officials of the Department cooperated closely with the Committee, utilizing statistical and other data furnished by the Patent Office. Following completion of this work and the hearings before the Committee, several measures were recommended to the Congress for enactment. The objectives of these bills are stated in this report in the section below devoted to activities of the Patent Office.

Outstanding studies still in progress include those being made of the structure of industry in the United States, of the nature and influences of trade associations, and of the financial experience of representative corporations through successive phases of the business cycle.

Under the first of these studies an analysis is being made of the concentration of production of each of nearly 2,000 products. The trade association study is an attempt to determine and evaluate the effect of trade-association policies on the economy as a whole. The third project is a series of case studies to obtain a comprehensive view of the effect of cyclical changes upon business policies.

Other studies which were under way at the close of the year treated: The births and deaths of business enterprises; export prices in relation to domestic prices of the same firms; Government competition with business; export associations operating under the Webb-Pomerene Act; credit needs of small business; organization of the construction industry; taxation of business enterprise; recent changes in buying methods; extent and location of foreign ownership in American business.

In addition to these studies, representatives of the Department participated before the Committee in the economic prologue to its hearings and in the hearings on patents and on the construction industry. Because of the great potential contribution of the Temporary National Economic Committee to the making of economic policy, I regard the work of the Department for the Committee as of the highest importance.

FOREIGN-TRADE ZONES BOARD

Among the important interdepartmental functions in which the Department of Commerce participates, the Foreign-Trade Zones Board is of particular significance for import and reexport trade. The purpose of the statute which created the Board—consisting of the Secretaries of the Treasury, War, and Commerce, the latter being chairman—is to provide zones in the United States where goods may be landed free of duty. Appropriate facilities provided by public or private corporations, who must be authorized by the Board to operate zones, permit the preparation of goods for domestic distribution before import duty is imposed and the repackaging and other manipulation of goods for reexport.

As of June 30, 1939, the Board has issued two grants for the establishment of foreign-trade zones—the first to the city of New York for a foreign-trade zone at Stapleton, Staten Island, and the second to the Alabama State Docks Commission for a foreign-trade zone at Mobile. The Mobile zone, which was inaugurated in July 1938, was closed several months later on the petition of the Governor of Alabama and the grant was formally withdrawn.

Early in 1938 the city of New York employed a private company to take over the actual work of promoting and operating the foreign-trade zone. As a result of this arrangement, activities in the zone were greatly extended and new operations undertaken. Representatives were sent to several European shipping centers to develop traffic for the zone.

Pending receipt of further necessary information, there were held in abeyance applications from the Board of State Harbor Commissioners at San Francisco, from a private corporation at Jersey City, N. J., and from the Puerto Rican Government for a zone at San Juan.

COOPERATION WITH DEPARTMENTS OF AGRICULTURE AND JUSTICE

The Department's work during the past year in cooperation with the Departments of Agriculture and of Justice serves to illustrate concretely the function of this Department in helping form Government policies that affect business.

The food-stamp plan of the Department of Agriculture, which was inaugurated in the latter part of the fiscal year, is designed to provide for the orderly and flexible transfer of surplus foods from producers to low-income families. The Department of Commerce was invited to participate in the preparation of this plan, and was particularly happy to do so because of the proposed utilization of the normal channels of distribution. The success of the plan and its favorable reception by the business community were evident from the early stages of its initial trial. The food-stamp plan is significant, not merely as a technique for the solution of a critical problem, but as a demonstration of the benefits derived by all parts of the economy from an adjustment to a higher level of consumption.

The Department's cooperation with the Department of Justice was related to three industries in which situations prevailed that appeared to require prosecution under the antitrust laws. The objective in the cooperative studies that were begun during the year has been to secure a full view of the problem in its economic as well as its legal aspect. By achieving this it is anticipated that in some cases the situation will be found not to warrant prosecution. In others the necessity for prosecution may be avoided through agreements worked out in consultation with industry that eliminate objectionable practices. Where prosecution is found unavoidable, the legal-economic study provides a more satisfactory basis than one in which no attempt has been made to analyze the economics of the industrial situation and to interpret it in terms of legal concepts that originated in a simpler economy.

BUSINESS ADVISORY COUNCIL

This organization completed the sixth year of its service to the Department and the Federal Government as a clearinghouse for the businessman's point of view on administrative policy-affecting business. I am happy to acknowledge the useful service rendered by these public-spirited businessmen serving without remuneration.[1]

[1] Members at the close of the fiscal year were:

W. A. Harriman, *Chairman*

F. B. Adams, New York, N. Y.
*Wm. L. Batt, Philadelphia, Pa.
*J. D. Biggers, Toledo, Ohio.
James F. Brownlee, Louisville, Ky.
Vannevar Bush, Washington, D. C.
C. A. Cannon, Kannapolis, N. C.
W. Dale Clark, Omaha, Nebr.
*Wm. L. Clayton, Houston, Tex.
Carle C. Conway, New York, N. Y.
Harvey Couch, Pine Bluff, Ark.
W. Howard Cox, Cincinnati, Ohio.
Wm. H. Danforth, St. Louis, Mo.
*R. R. Deupree, Cincinnati, Ohio.
*Wm. C. Dickerman, New York, N. Y.
*Gano Dunn, New York, N. Y.
W. Y. Elliott, Cambridge, Mass.
T. Austin Finch, Thomasville, N. C.
Robert V. Fleming, Washington, D. C.
*J. F. Fogarty, New York, N. Y.
*M. B. Folsom, Rochester N. Y.
*Clarence Francis, New York, N. Y.
H. B. Friele, Seattle, Wash.
*Rolland J. Hamilton, New York, N. Y.
Henry I. Harriman, Boston, Mass.
*W. A. Harriman, New York, N. Y.
Henry H. Heimann, New York, N. Y.
George A. Hill, Jr., Houston, Tex.
Thomas S. Holden, New York, N. Y.
Charles R. Hook, Middletown, Ohio.
Jay C. Hormel, Austin, Minn.
H. P. Kendall, Boston, Mass.
Fred I. Kent, New York, N. Y.
De Lancey Kountze, New York, N. Y.
Arthur Kudner, New York, N. Y.
Morris E. Leeds, Philadelphia, Pa.
C. K. Leith, Madison, Wis.
Paul W. Litchfield, Akron, Ohio
Earl M. McGowin, Chapman, Ala.
Geo. H. Mead, Dayton, Ohio.
James D. Mooney, New York, N. Y.
D. M. Nelson, Chicago, Ill.
J. C. Nichols, Kansas City, Mo.
Richard C. Patterson, Jr., New York, N. Y.
*George A. Sloan, New York, N. Y.
*E. R. Stettinius, Jr., New York, N. Y.
*R. Douglas Stuart, Chicago, Ill.
Walter C. Teagle, New York, N. Y.
J. T. Trippe, New York, N. Y.
*Sidney J. Weinberg, New York, N. Y.
W. H. Wheeler, Jr., Stamford, Conn.
A. D. Whiteside, New York, N. Y.
S. Clay Williams, Winston-Salem, N. C.
R. W. Woodruff, Wilmington, Del.

*Member of the Executive Committee.

During the past year 12 formal reports were submitted by the Council to the Secretary; these reports remain confidential except as otherwise determined by the Secretary. The Council gave valuable support to my recommendations for the creation of a staff of experts in the office of the Secretary and for the revision of the patent laws.

The Council cooperated with the Central Statistical Board, the Treasury Department, and the Social Security Board. A promising phase of its work during the past year was in cooperation with the Council of State Governments in stimulating consideration of the problem of interstate trade barriers.

BUREAU OF FOREIGN AND DOMESTIC COMMERCE

The general purposes to be served by a reorganization of the Bureau of Foreign and Domestic Commerce have been already outlined. The steps taken during the past year toward improvement of the functioning of the Bureau were largely concerned with setting up the new Division of Business Review and the simultaneous reorganization of the two domestic research divisions.

Through the elimination of nonresearch functions, these two divisions have been enabled to pursue research more effectively. A program of research that is both broader and more intensive than in the past was launched during the year in cooperation with the Temporary National Economic Committee and constituted a major part of the year's work. This program has beeen discussed above, and it is planned to continue with similar research projects after the Committee has completed its special function.

By drawing into one specialized division the functions of interpreting data for business and other purposes, it has proved possible to marshal more effectively the results of the activities of the other divisions of the Bureau. As budgetary plans are fulfilled for the expansion of treatment of domestic factors to a degree comparable to that which has been given to foreign-trade problems, it is expected that the new division, working with the others, will discharge its vital function with a high degree of effectiveness.

National income studies.—Among the fundamental research work of the Bureau, the national income studies received special emphasis because of their fundamental significance. During the year estimates of income payments by States and by types of payment were prepared for the period 1929–37, and this series will be maintained as part of the regular annual estimates of income. Completion of this study was hastened so it might be available to the Congress and the Social Security Board in considering revisions of existing legislation to which the problem of income distribution by States was basic.

The Bureau's monthly index of income payments, which has received especially close attention during the past 2 years because of business fluctuations, was revised during the fiscal year. This revision was required by the increasing use of the index as a measure of consumer purchasing power. As the original purpose in constructing the index was to provide a current series comparable with the annual estimates of income paid out, the index was deficient for the major purpose for which it had come to be used. Consequently, a general revision was made so that the series more closely approximated the cash or disposable income flowing to individuals.

To supplement estimates of income payments, data are needed on the volume of consumer outlays to determine whether income is flowing promptly back into business channels. In the absence of a direct measure of this flow, the Bureau has for the past several years been extending its sample of retail sales data for the purpose of obtaining eventually a comprehensive picture of retailing on a national and regional basis. The data were developed during the past year to a point which permitted the issuance for the last two quarters of the fiscal year of estimates of the total dollar volume of retail sales, with comparative data for the major types of retailing. These estimates revealed an increase of a billion dollars, or 6 percent, in the value of retail sales in the first half of the calendar year 1939 over the corresponding period of 1938.

Intensification of marketing research, with its accompanying requirement for more adequate regional marketing information, was fostered by several major studies completed during the year. The most important of these was the preparation of data on industrial markets in each of the 3,071 counties in the United States.

As is usual in a period of declining sales and income, credit problems have engaged increasing attention. The abrupt drop in sales of consumer durable goods after the middle of 1937 raised a question as to whether liberalization of installment terms during the period of rising business volumes, and the tendency to reverse such policies during a period of declining trade, had not exerted an important influence upon the extent of business contraction which actually took place in 1937–38. A study of this situation by the Bureau developed the conclusion that, while restriction of terms probably did not reduce sales to an important extent, liberality during the earlier rising phase of business had contributed to the subsequent reduction in the demand.

A further contribution to the factual data available in this general field was the first annual survey of bad-debt losses made jointly by the Bureau and the National Association of Credit Men. Measures of the volume of long-term debts were brought up to date, revealing a further contraction of about 4 billion dollars, or more than 5 percent, in the total of private long-term debts outstanding during the 3-year period 1934–37.

Foreign trade problems.—In the foreign field, special developments during the year were related to the growing dislocation of world trade. Surveys of new sources of materials, the evaluation of substitutes, and more intensive investigation of new or minor markets were made. In addition to dislocations caused by war scares and the migration of minorities, positive restrictions upon world commerce have continued to present a very serious problem. The adaptation of a consolidated Foreign Service to this new type of problem has already been discussed. In addition to full coverage abroad, however, it is important that the information transmitted by Foreign Service officers be fully utilized.

Much research has been necessary to provide timely and adequate information for the guidance of American exporters. The various exchange restrictions imposed by foreign governments have created a problem of obtaining effective payment in dollars quite apart from the ordinary difficulties of securing and holding foreign markets for American products. Imports from the United States are frequently on a different footing from shipments originating in other countries,

notably in cases where clearing and compensation agreements are in effect or in which bilateral trade results in an excess of exports from this country.

In the case of barriers to commodity trade, there has been increasing resort to measures beyond the familiar tariff duties. For example, quota systems which stipulate maximum quantities of specified commodities which may be imported from all countries, or from designated countries, or even by individual importers, have become common. The restrictions imposed upon international trade and payments constitute no settled order which can be satisfactorily analyzed or summarized at infrequent intervals. Since changes in regulations are generally made by the administrative action of authorities acting under broad discretionary powers, changes may be literally daily occurrences. The situation has been rendered the more confusing during recent times by political dislocations in Central Europe and Asia and by the formation of trade areas and currency blocs to which access from outside areas is completely or partially closed by the use of extraordinary control devices.

These developments in foreign commerce have emphasized the importance of the informational and research activities of the Bureau, on the one hand, and the Bureau's participation in the trade agreements program, through its Trade Agreements Unit, on the other. Individual firms and financial institutions are often entirely unable to cope with the new problems arising in the conduct of foreign trade. New forms of competition in the foreign market, new and formidable obstacles to trade, and frequent interference with the free flow of international payments have made it imperative that American business and finance be kept advised on day-to-day developments in the field of trade and exchange restrictions. This service has aided not only in the maintenance of foreign trade; it has prevented also serious losses which would otherwise have resulted from the failure of exporters to secure clearance of shipments by foreign customs and exchange authorities or to receive payments from foreign purchasers promptly or at all.

Since, under present-day circumstances, knowledge of detail is often meaningless without knowledge of the whole, the broader research activities of the Bureau in the realm of foreign commerce have gained added significance. Businessmen and bankers have been assisted in the management of their affairs in other countries through the comprehensive analysis by the Bureau of general conditions abroad, as well as of developments in the trade and financial relations between the United States and foreign countries.

During the year the Bureau has been able to speed up the publication of export and import statistics; and its information on trade opportunities abroad was provided for 250,000 firms—an increase of 50 percent over the previous year. Studies begun for the Temporary National Economic Committee included some on economic concentration and fundamental economic changes in certain foreign countries.

Publications.—In addition to the regular statistical and informational publications of the Bureau, a number of publications, some of them embodying the results of studies described above, were issued during the year. Of particular interest are the following: Industrial Market Data Handbook; State Income Payments, 1929–37; Residen-

tial Building; Oversea Travel and Travel Expenditures in the Balance of International Payments of the United States, 1919–38; The United States' Place in India's Trade; and several studies of living costs for Americans in selected foreign lands.

During the year the chairman of the House Committee on Interstate and Foreign Commerce requested my comments on a bill to promote business and economic research and establish research stations in the several States to cooperate with the Department of Commerce. After discussing this measure with a committee representing the conference of State university schools of business, I was glad to recommend its enactment with certain amendments. It appeared highly desirable to place increased emphasis on practical research that would be of aid to small business and to provide more adequate facilities for coordinating research carried on by the individual institutions. This measure, it seems to me, would, if enacted, permit the Bureau of Foreign and Domestic Commerce to perform a very useful role in aiding small business through the cooperative development of an integrated program of research on the problems of such enterprises.

BUREAU OF THE CENSUS

The principal activity of the Bureau of the Census during the fiscal year was preparation for the Sixteenth Decennial Census. The preliminary work for this census exceeds in breadth and exhaustiveness that for any previous census. Every effort has been made to meet the highest requirements of statistical science and to insure that the inquiries shall be timely without sacrificing continuity with the data of earlier censuses.

Emphasis formerly placed upon factors relating to immigration has been shifted, for the new census, to the problem of internal migration. As the rate of population growth has declined, the factor of internal movements has become increasingly important in determining the future population in the various parts of the country. Equally important are factors of differential fertility, which indicate the growth to be expected from births in the various sections. Many business and professional plans are vitally affected, both by the prospective growth of population and by the existing and prospective age composition of population in market areas. To meet the requirements for more complete knowledge of these important factors, inquiries will be included in the 1940 census that will enable the making of exhaustive studies of differential fertility.

These same migration and fertility factors are of course of vital interest to Government agencies as well as to businessmen. Not only is a large part of the Federal program designed to meet special requirements at different age levels, but State and local units of government must be prepared to meet the responsibilities that changes of population involve.

The usefulness of the census as an adjunct to Federal policy is particularly well demonstrated in the special census of housing authorized by the Congress to be made as part of the regular decennial census. Primarily designed to provide information for the Congress and the Federal agencies concerned with the housing program, it will also be of great service to the construction industry and allied businesses.

In the preparation of the inquiries, their ultimate objective of producing needed data for public and private purposes has been kept to the fore through constant consultation with interested parties. The Federal agencies concerned with social security and housing as well as the Treasury Department and the Veterans Administration, among others, have collaborated in the preparation of inquiries. Conferences with representative business and private research organizations have been frequent. On technical matters experts of wide reputation have been constantly consulted.

The 1940 census will provide for the first time information on the salaries and wages of all workers. This not only is far more accurate than estimates based on relatively small samples but, in conjunction with other data from the census, will enable us to know more accurately than ever before how people live at various levels of income. It will also provide a valuable index of purchasing power for use in planning marketing programs.

As a final check on the statistical utility of the inquiries to be used in the 1940 census, a "trial census" was planned to be made during the summer of 1939. In two selected counties the tentative census schedules were to be used, and in the light of actual experience with them final revision was to be made.

Although preparations for the coming census assumed the principal role during the year the regular work of the Bureau was carried on and several activities were improved and expanded.

Statistics covering 351 industries and several special subject reports became available during the year as a result of the 1937 Census of Manufactures. Reports by industries were prepared for the 33 industrial areas, and a summary showing general statistics for all industrial areas was issued in April 1939.

The 1937–38 Census Survey of Business, completed in February 1939, presented trend data on net sales, credit sales, pay rolls, and stocks for identical retail stores and wholesale establishments for 1935, 1937, and the first half of 1938 correlated with the complete census data for 1935. The canvass covered 133,000 retail stores and 18,500 wholesale establishments.

In the field of vital statistics the Bureau has designed a new uniform State vital statistics act for consideration of State legislatures, which standardizes the reporting of births, stillbirths, deaths, and marriage and divorce. New standard birth, death, and stillbirth certificates were prepared and recommended for adoption by the States. Forty States have already indicated that they will adopt the forms prior to 1940.

The Bureau has also extended its work on the reporting of information on State and local governments. The gathering of statistics of State governments, which was discontinued in 1932, was resumed during the past year with the compilation of State reports for 1937. Improved classifications have been developed for reporting financial statistics of States and cities, and new inquiries concerning employees and pay rolls have been added.

Age search requests answered by the Bureau reached a total of 123,133 during the year. This service has become one of increasing importance as demand grows for proof of age in connection with old-age benefits and other programs.

Carrying forward a program initiated in 1935, the Bureau has increased the efficiency of its staff by means of in-service training and recreational and welfare programs. Plans were also made for extending the benefits of these activities to temporary personnel hired in connection with the 1940 census.

NATIONAL BUREAU OF STANDARDS

The National Bureau of Standards appeals to me as being an agency of peculiar importance in an industrial civilization. The growth of mass production, with its benefits to all through raising the standard of living, requires almost unbelievable accuracy and uniformity of measurement. The contribution of this Bureau to the development of our modern economy through the establishment of standards, not alone of measurement but of all types of tests and specifications necessary in modern industry, is a very great one.

The work of the Bureau ranges over a very wide field. A significant part is done in cooperation with similar bureaus of foreign governments. During the past year it took an active part in an international program to establish electrical standards on a uniform absolute basis. It also completed its part of the international research on the properties of steam. The results of this cooperative undertaking will provide a sound basis for world uniformity in tabulating the properties of steam, on which the efficient design of modern power-plant equipment depends.

Cooperative programs in this country to which the Bureau has contributed have included continuation of a field study of highway truck scales. This work, done in cooperation with the weights and measures officials of the various States, shows clearly a great need for the systematic testing and inspection of highway scales. Of those tested so far, 75 percent were found to be inaccurate. Fifteen States have taken steps to secure the necessary equipment for systematic testing.

In cooperation with the Navy Department and the Weather Bureau, a weather instrument has been developed which contains a very light radio sending set that is automatically actuated by temperature, humidity, and pressure. Through the use of this instrument observations may readily be secured to a height of 50,000 feet, as contrasted with the 18,000-foot practical limit to airplane observations. The reliability and low cost of this device have caused it to be put into active service in securing the daily determinations of upper-air conditions, which are now recognized as being of great value in forecasting the weather, particularly in connection with air transportation.

Among the practical public services rendered by the Bureau was the testing, in cooperation with the Corps of Engineers, of a hydraulic model of the Indian Rock Dam that will protect the city of York, Pa., against floods. The model tests showed that changes in the proposed design of the stilling basins were desirable, thus saving expensive changes in the full-scale structure later on. Another such service was performed for the city of Columbus, Ohio, through the investigation of technical questions involved in the dilution of natural gas with flue gas by a public utility.

Technical advances during the year included development of a new instrument for measuring the hardness of glass and other materials,

improvement of analytical methods for ferrous metals and for metals of the platinum group, and better method for the analysis of gases. The Bureau has been able to measure for the first time the end-on compressive strength of thin sheet metal, an important factor in airplane design, and has developed certain treatments of the cooling water in air-conditioning systems that will minimize corrosion.

An important aspect of the Bureau's work is the routine testing of materials and the development of standard specifications to make such testing by laboratories throughout the country more useful and more uniform. Over 7 million barrels of cement were tested during the year for the Federal Government and the sixth inspection tour of commercial cement-testing laboratories was started under the direction of the Cement Reference Laboratory, which is maintained jointly by the Bureau and the American Society for Testing Materials. Thirteen new simplified practice recommendations and an equal number of commercial standards were released in printed form, and many conferences were held with manufacturers, distributors, and consumers, which will lead to additional projects.

The desirability of expanding the functions of the Bureau to provide greater service for consumers has become more and more apparent in recent years. For some time the Bureau has provided valuable assistance to such public consumers as State and local governments. During the past fiscal year 500 purchasing officers of States, counties, and municipalities were furnished with information concerning the use of specifications in buying supplies. In addition to this there is need for service to the general consuming public.

In recognition of the interest of consumers and retailers in the establishment of performance standards, legislation was proposed during the fiscal year that would create an interdepartmental Performance Standards Board with the Secretary of Commerce as chairman. The Board would determine when the public interest required that standard grades, based upon performance to the consumers, be set up for any product. Funds would be provided to enable the Bureau to carry out the necessary work and develop consumer standards based on performance. This appealed to me as an eminently desirable extension of the functions of the Bureau and I was therefore very happy to endorse this bill.

UNITED STATES PATENT OFFICE

Study and formulation of legislative measures for the improvement of the patent system have engaged the Commissioner of Patents and his associates during much of the period intervening since the last previous report. Enactment of the various betterments proposed was urged by individuals and groups representing industry, large and small, by inventors, by the Patent Office Advisory Committee, and by the Business Advisory Council of the Department of Commerce. Following hearings by the Temporary National Economic Committee, the proposed legislation was presented to Congress by the Secretary toward the close of the fiscal year and had promise of prompt and favorable action by the several committees to which it was referred.

The collective purpose of these bills was to reduce the time and cost of issuing and litigating patents, and thus not merely safeguard the rights of applicants and patentees but also serve the public interest

by speedy and final determination of questions affecting the users as well as the owners of patented inventions. Chief among the objectives sought by one of the bills before Congress was the establishment of a single court of appeals for patents. This court, if created, would adjudicate issues involving ownership, validity, and infringement of patents arising in any part of the United States and its territories, and by the uniformity and universality of its decisions, would obviate the delays, conflict, and much of the burdensome expense at present attending the adjudication of such questions by the 10 Circuit Courts of Appeals. Passage of the other measures submitted to Congress would expedite the prosecution and issuance of applications for patents and correct certain abuses which the existing statutes fail to prevent or to remedy.

The Patent Office was for several months in continuous cooperation with the Temporary National Economic Committee during the latter's inquiry into the "concentration of economic power," insofar as such centralization was alleged to be furthered by the use or misuse of patents. Statistics and other facts needed for the committee's information and guidance were presented by the Commissioner in his testimony, and he also arranged for the introducton of evidence by inventors, engineers, manufacturers, and others having special knowledge of patents and their significance to business and industry.

The number of applications for patents (including reissues) and for registration of trade-marks, prints, and labels filed in the period covered by this report was slightly less than the aggregate received in 1938, but with that exception their total was larger than that for any previous year since 1931. In the latest fiscal period 91,163 such applications were filed, as against 92,018 in 1938. Further increase was recorded in design patents granted. Their number in 1939 was 5,154, the largest in the history of the Office.

While the inflow of new applications was only a little less in 1939 than in 1938, there was an acceleration in their dispatch. The total number of cases disposed of was 69,243, or 9,075 more than in 1938. Cases awaiting action by the examiners at the end of the latest fiscal year were 42,215, as against 45,723 on June 30, 1938. The total of applications pending at the close of 1939 was 113,277, or 2,764 fewer than on June 30, 1938.

Prompt and correct classification of patents is one of the requisites of accurate and expeditious determination of the patentability of inventions sought to be patented. During the fiscal year extensive revision of classifications was carried out and a new classification of rubber compositions was completed and incorporated in the structure. A large number of miscellaneous patents were transferred to more appropriate classes. Reclassification was of course accompanied by thorough revision and extension of cross-references.

BUREAU OF MARINE INSPECTION AND NAVIGATION

The fiscal year 1939 was the third consecutive year in which the shipbuilding industry established a new record in the volume of vessel tonnage under construction. Extensive alterations were made to existing vessels and many laid-up vessels were reconditioned for active service. These vessels are subject to rigid inspection during

the process of construction to insure conformance with approved plans and specifications and, like all other vessels subject to the jurisdiction of the Bureau, are inspected periodically after they have been placed in service to insure that they are being maintained in a seaworthy condition.

Among the achievements of this Bureau during the fiscal year was the application of new rules and regulations to vessels under construction and the revision of existing rules and regulations for the adequate protection of life and property at sea. Additional safeguards against fire, improved machinery and equipment, and better trained and more efficient officers and crews were prescribed by the Board of Supervising Inspectors and by new provisions of law.

The Bureau's safety program relative to adequate subdivision was extended during the year to include all inspected river passenger vessels and ferry vessels. This requirement precludes the rapid sinking of these vessels and insures positive stability, if and when any one main compartment is flooded. This requirement was made effective to new vessels on July 26, 1938, and to existing vessels on April 15, 1939.

The Bureau has continued, with gratifying results, its campaign of instructing crews of passenger and excursion vessels in the performance of their duties and in conducting frequent and thorough fire and lifeboat drills. These efforts, together with the cooperation of the industry, have resulted in an efficient working organization of masters, officers, and crews on American vessels.

Another important accomplishment of the Bureau was the preparation and publication of a standard form for station bills, which eliminates the confusion and difficulty experienced by masters and officers of vessels in the preparation of suitable station bills in compliance with the General Rules and Regulations. This standard form provides for uniform signals, instructions, and assignment of the entire crew to stations and definite duties that they would be required to perform in the event of an emergency, such as fire, man overboard, or abandon ship.

It is a pleasure to report that during the year no passenger life was lost on any inspected vessel of the United States as a result of casualty, defective equipment, or culpable fault on the part of the licensed officers or certified personnel comprising the crews of our merchant vessels. During the past 4 years 1,107,507,424 passengers have been carried on inspected merchant vessels of the United States with the loss of but one passenger attributable to the causes just referred to.

This record has been made possible by a number of factors, notable among which are the officers and men manning our merchant vessels, who have become "safety conscious" and realize that eternal vigilance is the price of safety; the cooperation of steamship owners and operators; the efforts of Bureau employees; and the effectiveness of rules and regulations that have been promulgated for the protection of life and property at sea.

The Bureau has continued its work in connection with the preparation of rules and regulations which have for their purpose the elimination of hazards caused by the carriage of so-called dangerous cargoes.

Enabling legislation was introduced in Congress but not acted upon prior to the close of the fiscal year.

The demands of modern living and the needs of society for considerable quantities of these so-called dangerous substances in everyday life requires that the art of transportation be developed to its highest degree in their movement. Carriers have met these demands to the best of their ability under existing laws, which in most instances are obsolete and restrictive. The need for accurate and complete regulation of such dangerous substances when moving in commerce has been pertinent and pressing for a considerable time and is recognized and treated by the leading maritime nations as well as the Panama and Suez Canal authorities.

UNITED STATES COAST AND GEODETIC SURVEY

Notable achievements have been accomplished in promoting the protection of water-borne commerce throughout our coastal waters during 1939 by the United States Coast and Geodetic Survey, which is charged with the survey of such waters and the printing of nautical coastal charts.

Modern hydrographic surveys, which have been in progress for the past 4 years along the coasts, were processed and the resulting data printed to form the most advanced charts to be made available for the mariner. Through methods and instruments developed by the Bureau, comprehensive knowledge of the sea-bottom topography was obtained by its survey ships in offshore areas. Depicted on the new coastal charts by detailed depths and outlined by contours are submarine features which can be recognized as definitely as those on shore. The mariner whose ship is equipped with means for obtaining echo soundings can use these charts not only to locate his ship's position with assurance, but to eliminate all hazards of stranding in periods of low visibility, as in fog, rain, or snow.

A definite saving in operation costs was made by the further development of floating equipment for fixing the positions of survey ships doing offshore sounding. Sonoradio buoys, designed and constructed during winter lay-up periods by survey personnel, have entirely displaced the station ships previously moored offshore for the same purpose. The vessels released from this duty were actively engaged in hydrographic work and accomplished surveys needed to advance the program along the Atlantic and Gulf coasts.

In the waters surrounding the Aleutian Islands and along the Alaskan coast excellent progress was made, considering the handicap of bad weather, in the extension of surveys into these uncharted areas. Considered of vital need to the national defense, the charting of these waters must precede their use as a theater of fleet operations. Several of the survey ships were concentrated in this general vicinity during the working season. It is gratifying to note the progress of construction of two new ships with funds allocated for this purpose. Designed for duty in the Aleutian Island surveys, these new ships will replace older vessels less adapted to the hazardous work in the isolated regions farther westward.

The better-known products of the Bureau are distributed by sale to the public and issue to Government departments. The call for

nautical charts of all coastal areas continued in heavy volume but was slightly less than the record issue of the previous year. Related navigational publications increased 10.8 percent over 1938 and were nearly double the needs of a decade ago.

The distribution of aeronautical charts showed a remarkable increase of 22½ percent. This is attributed to an increasing desire for safe navigation through use of the aeronautical charts and to the extension of aerial facilities which are prominently noted thereon. Constant revision of these charts is needed to show the changing conditions of the airways and other improvements for the advancement of this industry.

There has been a public awakening to the need for basic control of all surveys, public and private, throughout the country. Some progress has been made by new surveys but considerable destruction of old monuments has occurred through improvements and widening of roads and new construction. The Bureau's control surveys are an essential preliminary to topographic mapping and the early inauguration of a program of such surveys would anticipate demands for this basic data.

Substantial improvements were made to the structural facilities of magnetic observatories and to stations maintained for the automatic recording of tides. New construction and needed alterations have been accomplished.

BUREAU OF LIGHTHOUSES

Among the major activities of the Lighthouse Service during the past year was the rehabilitation of light stations and the repair of the extensive damage done over a large section of the New England coast by the hurricane of September 21. Prompt steps were taken, following the hurricane, to restore all navigational aids to service, and at the close of the year a large part of the necessary rebuilding had been completed.

An allotment of $1,680,000 made by the Public Works Administration, provided for the construction and reconditioning of lighthouse tenders and lightships. Six new tenders were constructed with these funds, and three additional vessels were built with special vessel appropriations.

The superintendents of the 17 lighthouse districts assembled in the Department of Commerce building on October 6 for a 10-day conference. The last previous similar conference had been held in 1935. The sessions were devoted to the coordination of technical and administrative procedures in the far-flung service in the interest of uniformity and increased efficiency in all areas.

The total number of aids to navigation maintained by the Lighthouse Service at the close of the fiscal year was 29,606, a net increase of 849 over the previous year. Of the additional aids established, 377 were lighted aids, 42 were sound signals, and 457 were unlighted buoys and daymarks. During the year 8 new radiobeacons were established.

The year 1939 marked the one hundred and fiftieth anniversary of the initiation of lighthouse activities under the Federal Government, for on August 7, 1789, the first United States Congress, by the ninth act which it passed, provided that lighthouses, buoys, beacons, etc., which

had previously been erected and maintained by the various colonies, be henceforth supported by the Federal Government. This act, by providing for the erection and maintenance of lighthouses and other aids to navigation, was the origin of the United States Lighthouse Service. Suitable observance of the one hundred and fiftieth anniversary was called for by a joint resolution of Congress, which designated the week of August 7, 1939, as lighthouse week.

The extension of the civil-service principle to additional groups of Lighthouse personnel, provided for by two Presidential orders, was made effective through appropriate administrative action during the year. A much-desired result, which was secured, was the promotion of suitable incumbents to more responsible positions. About 450 positions were affected by the two Presidential orders, including petty officers and stewards on vessels and light attendants.

BUREAU OF FISHERIES

The calendar year 1938 was characterized by reduced unit values for most manufactured fishery commodities. Similarly, average prices received by the fishermen for many principal species were lower than in the preceding year. While an increased production of some fishery commodities was sufficient to offset these decreased unit values in the earnings of certain segments of the industry, such instances were not common. Consequently, decreased revenue from the commercial fisheries was rather generally reflected throughout the year.

In an effort to improve the marketing situation for fishery products, three additional offices have been established by the Bureau of Fisheries Market News Service—in Chicago, Ill.; Seattle, Wash.; and Jacksonville, Fla. From these offices and from offices in New York City and Boston, daily reports are issued showing species, quantity, price, and other pertinent facts relating to market values.

A survey of fresh- and frozen-fish marketing conditions was completed late in the fiscal year in 50 representative cities east of the Mississippi. The purpose of the survey was to determine variations in consumption of fish among various social and economic groups, or residents, in these cities in an endeavor to improve retail fish business and inform our people concerning the value of fish in the daily diet. The results of the survey will be made available to retailers as a guide to improved business practices in disposing of their commodities.

The annual domestic per capita consumption of fish in the United States amounts to only 13 pounds, which is less than that in most of the important countries of the world. This low consumption of fish not only curbs the potential growth of our commercial fisheries but also is evidence of the restricted quantity of these healthful foods in the average diet. Studies of the Bureau indicate that fishery products are excellent sources of magnesium, phosphorous, iron, copper, iodine, and other minerals which nutrition specialists have determined to be necessary for proper development and maintenance of the human body. During the fiscal year studies on the effect of ultraviolet irradiation of haddock fillets have shown that exposure of the fillets to these rays for a period of time increased the antirachitic value or vitamin D potency of the fillets. Tests are being conducted on other fishes under varying conditions to determine the ex-

tent to which the process may be applicable on a commercial scale.

Progress has been made also during the year in the development of a well-balanced program of biological investigations to direct conservation of our important food fishes. In the offshore waters of New England the principal problems under investigation are studies to determine the causes of the great fluctuations in the yield and development of methods which will reduce these fluctuations. Studies of this type are being carried on for the haddock, mackerel, flounder, and a number of species which collectively make up the groundfish catch. As a result of these studies a plan for the management of the haddock fishery is being developed. In the inshore waters a program to increase the number of lobsters has been carried forward this season at the Boothbay Harbor station.

Investigations of the Atlantic coast shad fishery have presented evidence that an insufficient spawning escapement is the principal cause of the decline in this fishery, which has amounted to more than 80 percent in the past half century.

On the Pacific coast an extensive survey of Bristol Bay salmon resources was launched last year. In addition to offshore hydrographic and biological surveys, plans were made for a correlated investigation of the inshore fisheries. The fishways at Bonneville Dam on the Columbia River, which were designed and installed under the supervision of the Bureau of Fisheries, continued to function effectively. In 1938, the first year of operation, approximately half a million salmon and steelhead trout successfully ascended the ladders on their way to spawning grounds upstream. The plan for salvaging salmon blocked by the much higher Grand Coulee Dam was put in operation during the 1939 season. The fish are trapped at the Rock Island Dam, approximately 150 miles below Grand Coulee, and are transported in specially designed trucks to tributaries between Rock Island and Grand Coulee Dams, where they are held until ready to spawn. These activities will be continued for 5 years, or the complete life cycle of the salmon, with a view to transferring the entire run of upper Columbia River salmon to these lower tributaries.

Among the shellfisheries, oysters ranked first in importance with a take of 95,627,000 pounds, valued at $8,703,000. Among the fisheries of the United States in general, oysters ranked third in value and were exceeded only by the great salmon and tuna fisheries of the Pacific coast. Studies of the Bureau during the fiscal year have been directed toward developing more effective methods of oyster farming, and improvement in the quality of oyster meats. An important new project in oyster culture has been instituted in South Carolina. It is proposed to develop means of cultivating oysters at a profit on small farms, 2 to 10 acres in extent, to be leased and operated by tidewater residents; materials, equipment, and supplies being produced by the labor of the oyster farmer. In North Carolina a method is being developed whereby overcrowding of the beds may be avoided and oysters grown to a good size and shape.

International cooperation in the conservation of the fur-seal herd has resulted in an increase of the herd until now it numbers about 1,872,000 animals. During the calendar year 1938, 58,364 fur-seal skins were taken, an increase of 3.184 over the total for 1937.

Production for the Federal fish hatcheries exceeded 8 billion eggs, fry, and larger fish. Great increases were made in the number of commercial and semicommercial fishes. Continued effort has been made to raise fresh-water species to a size better able to withstand their natural enemies.

FISHERY ADVISORY COMMITTEE

The Fishery Advisory Committee is composed of representatives of the industry, serving without pay,[1] who act as advisors to the Secretary of Commerce and the Commissioner of Fisheries.

During the fiscal year 1939 the Committee continued its practice of working with organizations of the industry, and participated in the National Fishery Convention and a general session of the North American Council on Fishery Investigations. In its annual report to the Secretary of Commerce the Commitee developed a long-range program for the conservation and wise utilization of the Nation's fishery resources. It recommended an expansion of the biological, technological, and statistical studies of the Bureau of Fisheries to include ultimately a complete inventory of the Nation's fishery resources for the guidance of management practices.

APPROPRIATIONS AND EMERGENCY FUNDS

Detailed information as to direct and transferred appropriations, as well as emergency funds available for expenditure by the Department during the year will be found in the report of the Chief Clerk and Superintendent.

Reports of the various bureaus of the Department, setting forth their accomplishments during the year, are attached.

Sincerely yours,

HARRY L. HOPKINS,
Secretary of Commerce.

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[1] Members at the close of the fiscal year were:

Great Lakes and Inland Waterways Region:
O. L. CARR, Kansas City, Mo.
W. A. MELETIO, St. Louis, Mo.
JOHN R. SCHACHT, Philadelphia, Pa.
CHAS. W. TRIGGS, Chicago, Ill.
F. A. WESTERMAN, Lansing, Mich.
E. L. WICKLIFF, Columbus, Ohio.

Gulf Region:
A. M. ADAMS, Key West, Fla.
C. W. GIBSON, Corpus Christi, Tex.
JOHN LANASA, New Orleans, La.
FRANCIS WM. TAYLOR, Pensacola, Fla.
JOHN VERSAGGI, St. Augustine, Fla.

Middle Atlantic Region:
O. G. DALE, Jr., New York, N. Y.
W. A. ELLISON, Jr., New York, N. Y.
GEO. T. HARRISON, Tilghman, Md.
THOS. H. HAYES, Lewes, Del.
J. H. MATTHEWS, New York, N. Y.
H. A. MCGINNIS, Philadelphia, Pa.
LEWIS RADCLIFFE, Washington, D. C.
R. V. TRUITT, College Park, Md.

South Atlantic Region:
FRANK D. FANT, Jacksonville, Fla.
SOL FASS, Portsmouth, Va.
WILLIAM WESTON, Columbia, S. C.

New England Region:
THOMAS J. CARROLL, Gloucester, Mass.
E. H. COOLEY, Boston, Mass.
M. G. MAGNUSSON, Boston, Mass.
GARDNER POOLE, Boston, Mass.
RUFUS H. STONE, Portland, Maine.

Pacific Region:
H. J. ANDERSON, San Francisco, Calif.
LAWRENCE CALVERT, Seattle, Wash.
ARCH E. EKDALE, San Pedro, Calif.
H. B. FRIELE, Seattle, Wash.
E. B. MCGOVERN, Seattle, Wash.

Captain Sven Marthin, Wildwood, N. J., also served on the committee during the fiscal year.

REPORT BY BUREAUS

CHIEF CLERK AND SUPERINTENDENT

During the fiscal year 1939 the functions and activities under the jurisdiction of the Chief Clerk and Superintendent remained fairly current.

Preliminary plans for the Sixteenth Census necessitated considerable rearrangement of office space within the Commerce Building, and plans were completed and funds appropriated for the construction of the Federal Office Building which should be completed in sufficient time for housing the additional employees required to carry on the Sixteenth Census activities.

At the close of the fiscal year there were outside agencies housed in the Department of Commerce occupying 108,705 square feet of office space and 4,566 square feet of storage space. As a result of the location of these agencies in the Commerce Building it was necessary for the Department to rent 30,500 square feet of storage space to take care of some of the more inactive records of the Bureau of the Census. In addition the Department rented space in the amount of 180,000 square feet to take care of the preliminary activities of the Sixteenth Census. While it is recognized that outside space would be necessary for the Sixteenth Census activities, arrangements should be made for maintaining in the Commerce Building all of the regular activities, including inactive files and records which are at present in rented space.

Special effort was made during the latter part of the year to effect a proper settlement of the numerous exceptions which have been made by the General Accounting Office to expenditures made by the Department of Commerce, especially the exceptions against payments made by the N. R. A., the settlement of which is a responsibility of this Department. It is expected that the oldest of these outstanding accounts will be settled either by an adequate justification to the General Accounting Office in the explanation of the payments or by including them in a bill of relief to Congress for the remainder.

There follows a brief statement concerning the activities of the offices and divisions under the supervision of the Chief Clerk and Superintendent:

DEPARTMENT LIBRARY

The following statistical summary reflects the activities of the library for the fiscal year 1939, and the status of work as at the close of the fiscal year:

Library staff	15
Number of books and pamphlets in library	246,122
Number of periodicals and newspapers currently received	1,879
Number of books acquired and cataloged	7,323

Cards filed in catalog	21,490
Books prepared for shelf	6,652
Number of books circulated	40,313
Books bound	821
Books borrowed from Library of Congress and other libraries	2.031
Books loaned to other libraries	555
N. R. A. hearings circulated	1,920

DIVISION OF PURCHASES AND SALES

During the fiscal year 1939 there were placed 12,563 purchase orders, which, including freight, rent, and miscellaneous accounts, involved the expenditure of $1,570,884.96. These amounts show a decrease in orders of 1,510 over the fiscal year 1938 and a decrease in expenditures over the fiscal year 1938 by the amount of $3,714,799.25. This decrease was due principally to the transfer of the Bureau of Air Commerce to the Civil Aeronautics Authority.

There were 2,142 contracts approximating $4,951,662.09 submitted to this Division for examination by the various field offices of the Department. In addition to the above, there were 51 formal contracts, amounting to $617,200.82, prepared by this Division, making a total of 2,193 contracts examined and prepared, involving a total expenditure approximating $5,568,800.

Through the cooperation of the Procurement Division, Treasury Department, there was obtained by transfer, without exchange of funds, a large quantity of surplus and forfeited property. Also, there was transferred, without exchange of funds, from this Department to other branches of the Government, including the Procurement Division, surplus material valued at approximately $313,518.

DIVISION OF ACCOUNTS

The following table shows the amounts appropriated by Congress for the bureaus and offices of the Department for the fiscal year ended June 30, 1939, the amounts transferred to this Department from other Government departments and agencies, and the amounts transferred from this Department to other Government departments and agencies, exclusive of funds appropriated under the several emergency appropriation acts:

Bureau or office	Annual appropriation acts	Deficiencies and supplements	Transfers from other departments	Transfers to other departments	Prior year appropriations available for 1939	Balance of 1939 funds available for 1940	Net available for 1939
Office of the Secretary	$2,155,950		$66,705	−$665,658			$1,556,997
Bureau of Air Commerce	13,826,480	[1] $325,000		−13,086,450			1,065,030
Bureau of Foreign and Domestic Commerce	3,038,100		101,250			−$18,496	3,120,854
Bureau of the Census	2,090,000					−43,750	2,046,250
Bureau of Marine Inspection and Navigation	2,658,760						2,658,760
National Bureau of Standards	2,615,000	3,000	286,286	−355,400	$500,000	−99,412	2,949,474
Bureau of Lighthouses	11,737,600	837,000			503,800		13,078,400
Coast and Geodetic Survey	2,665,550		50,500	−15,000			2,701,050
Bureau of Fisheries	2,025,500	82,500			40,000		2,148,000
Patent Office	4,468,000	169,418					4,637,418
Total	47,280,940	1,416,918	504,741	−14,122,508	1,043,800	−161,658	35,962,233

[1] Section 8 of the Emergency Relief Appropriation Act of 1938.

EMERGENCY FUNDS

In addition to its regular functions, the Department has for the past several years participated in various emergency projects designed for the relief of unemployment and improvement of economic conditions generally. The following table shows the allocations or allotments made from emergency appropriations to the Department during the fiscal years 1934 to 1939, inclusive, and the obligations incurred against these funds:

	1934 to 1937, inclusive	1938	1939	Total
Office of the Secretary:				
N. I. R. A.:				
Allotments	$947,000			$947,000
Obligations	945,805			945,805
W. P. A.:				
Allotments	70,000	$20,620		90,620
Obligations	69,991	20,268		90,259
Total:				
Allotments	1,017,000	20,620		1,037,620
Obligations	1,015,796	20,268		1,036,064
Bureau of Air Commerce:				
N. I. R. A.:				
Allotments	2,083,303			2,083,303
Obligations	2,075,748			2,075,748
P. W. A.:				
Allotments	987,775			987,775
Obligations	978,964			978,964
C. W. A.:				
Allotments	199,603			199,603
Obligations	198,285			198,285
W. P. A.:				
Allotments	587,380	260,600	(1)	847,980
Obligations	549,973	259,927		809,900
Total:				
Allotments	3,858,061	260,600		4,118,661
Obligations	3,802,970	259,927		4,062,897
Bureau of Foreign and Domestic Commerce:				
C. W. A.:				
Allotments	372,275			372,275
Obligations	349,639	8,247		357,886
W. P. A.:				
Allotments	100,000			100,000
Obligations	99,968			99,968
Total:				
Allotments	472,275			472,275
Obligations	449,607	8,247		457,854
Bureau of the Census:				
C. W. A.:				
Allotments	2,524,736			2,524,736
Obligations	2,302,596			2,302,596
F. E. R. A.:				
Allotments	1,005,000			1,005,000
Obligations	844,961	48,427		893,388
W. P. A.:				
Allotments	11,017,448	83,000	$9,200	11,109,648
Obligations	10,746,381	77,000	9,180	10,832,561
Drought relief in agricultural areas:				
Allotments	1,000,000			1,000,000
Obligations	999,570			999,570
Census of partial employment, unemployment, and occupations:				
Allotments		850,000	10,000	860,000
Obligations		815,692	9,933	825,625
Total:				
Allotments	15,547,184	933,000	19,200	16,499,384
Obligations	14,893,508	941,119	19,113	15,853,740

[1] $325,000 appropriated under section 8 of the Emergency Relief Appropriation Act of 1938 included in table with regular appropriations.

	1934 to 1937, inclusive	1938	1939	Total
Bureau of Marine Inspection and Navigation:				
N. I. R. A.:				
Allotments	$93,043			$93,043
Obligations	92,039			92,039
National Bureau of Standards:				
N. I. R. A.:				
Allotments	100,000			100,000
Obligations	99,601			99,601
P. W. A.:				
Allotments	70,000			70,000
Obligations	69,997			69,997
W. P. A.:				
Allotments	75,000			75,000
Obligations	74,998	$2		75,000
Total:				
Allotments	245,000			245,000
Obligations	244,596	2		244,598
Bureau of Lighthouses:				
N. I. R. A.:				
Allotments	5,620,334			5,620,334
Obligations	5,607,495			5,607,495
W. P. A.:				
Allotments	20,000			20,000
Obligations	19,029			19,029
P. W. A.:				
Allotments		2,098,750	$1,620,900	3,719,650
Obligations			3,265,700	3,265,700
Total:				
Allotments	5,640,334	2,098,750	1,620,900	9,359,984
Obligations	5,626,524		3,265,700	8,892,224
Coast and Geodetic Survey:				
N. I. R. A.:				
Allotments	8,293,220			8,293,220
Obligations	8,286,209			8,286,209
P. W. A.:				
Allotments			2,050,502	2,050,502
Obligations			1,900,054	1,900,054
Total:				
Allotments	8,293,220		2,050,502	10,343,722
Obligations	8,286,209		1,900,054	10,186,263
Bureau of Fisheries:				
N. I. R. A.:				
Allotments	670,455		328,000	998,455
Obligations	670,075			670,075
C. W. A.:				
Allotments	38,391			38,391
Obligations	38,056			38,056
W. P. A.:				
Allotments	151,372		661,606	812,978
Obligations	151,372		586,071	737,443
P. W. A.:				
Allotments			1,142,550	1,142,550
Obligations			911,565	911,565
Total:				
Allotments	860,218		2,132,156	2,992,374
Obligations	859,503		1,497,636	2,357,139
Total, Department of Commerce:				
N. I. R. A.:				
Allotments	17,807,355		328,000	18,135,355
Obligations	17,776,972			17,776,972
P. W. A.:				
Allotments	1,057,775	2,098,750	4,813,952	7,970,477
Obligations	1,048,961		6,077,319	7,126,280
W. P. A.:				
Allotments	12,021,200	364,220	670,806	13,056,226
Obligations	11,711,712	357,197	595,251	12,664,160
C. W. A.:				
Allotments	3,135,005			3,135,005
Obligations	2,888,576	8,247		2,896,823
F. E. R. A.:				
Allotments	1,005,000			1,005,000
Obligations	844,961	48,427		893,388

	1934 to 1937, inclusive	1938	1939	Total
Total, Department of Commerce—Continued.				
Drought relief in agricultural areas:				
Allotments	$1,000,000			$1,000,000
Obligations	999,570			999,570
Census of partial employment, unemployment, and occupations:				
Allotments		$850,000	$10,000	860,000
Obligations		815,692	9,933	825,625
Grand total:				
Allotments	36,026,335	3,312,970	5,822,758	45,162,063
Obligations	35,270,752	1,229,563	6,682,503	43,182,818

Disbursements during the year ended June 30, 1939, from appropriations and from funds transferred from other departments, exclusive of Emergency Funds, were as follows:

Bureau or office	Appropriation for—			Total
	1937	1938	1939	
Office of the Secretary	$1,900.75	$452,966.20	$1,105,763.26	$1,560,630.21
Bureau of Air Commerce	32,720.70	937,440.44	1,065,030.00	2,035,191.14
Bureau of Foreign and Domestic Commerce	814.05	61,347.50	3,042,421.63	3,104,583.18
Bureau of the Census	27.50	54,814.90	2,053,032.90	2,107,875.30
Bureau of Marine Inspection and Navigation	1,472.55	112,995.78	2,522,037.98	2,636,506.31
National Bureau of Standards	3,849.92	43,751.30	2,359,885.89	2,407,487.11
Bureau of Lighthouses	28,360.44	864,152.12	10,875,629.27	11,768,141.83
Coast and Geodetic Survey	285.62	346,024.73	2,295,868.93	2,642,179.28
Bureau of Fisheries	44.88	263,047.93	1,758,475.24	2,021,568.05
Patent Office	101.20	221,469.05	4,492,474.38	4,714,044.63
Total	69,577.61	3,358,009.95	31,570,619.48	34,998,207.04

MISCELLANEOUS RECEIPTS

Office of the Secretary:	
Sale of Government property	$414.33
Other	254.75
Bureau of Air Commerce:	
Sale of Government property	5,005.87
Other	216.91
Bureau of Foreign and Domestic Commerce:	
Fees under China Trade Act	1,375.00
Sale of publications	39,176.51
Sale of Government property	516.10
Other	17.23
Bureau of the Census:	
Statistical services	2,034.69
Reimbursement, excess cost over contract price	2,834.59
Other	163.33
Bureau of Marine Inspection and Navigation:	
Tonnage tax, United States	1,686,016.56
Navigation fines	158,029.77
Navigation fees	207,015.88
Overtime service	45,230.65
Reimbursement for loss on continuous discharge books	2,710.35
Sale of Government property	104.16
Other	728.52
National Bureau of Standards:	
Testing fees	65,990.39
Other	12.60
Bureau of Lighthouses:	
Reimbursement, Government property lost or damaged	4,268.91
Sale of land and buildings	16,007.77
Sale of Government property	20,671.46
Other	7,183.77

Coast and Geodetic Survey:	
Sale of charts	$21,613.88
Sale of maps	5,716.71
Sale of publications	2,715.42
Sale of Government property	461.71
Other	51.77
Bureau of Fisheries:	
Sale of sealskins	170,989.89
Sale of foxskins	19,761.22
Sale of Government property	7,122.06
Other	8,803.56
Patent Office: Fees	4,527,292.16
Miscellaneous: Refund, State and local taxes	89.05
Total, Department of Commerce	7,030,597.53

DIVISION OF PUBLICATIONS

The following statement shows, by appropriation title, the amounts expended or obligated from appropriations available for printing and binding during the fiscal year 1939:

Title of appropriation	Available	Expended [1]	Balance [1]
Printing and binding, Department of Commerce	[2] $475,000.00	$466,076.59	$8,923.41
Printing and binding, Patent Office	[3] 859,417.93	859,417.93	
Customs statistics, Bureau of Foreign and Domestic Commerce	[4]	16,125.50	
Investigation of building materials, National Bureau of Standards	[4]	10,425.37	
Expenses of the Sixteenth Census, Bureau of the Census	[4]	1,287.00	
Salaries and expenses, Social Security Act, Bureau of the Census	[4]	5,000.00	

[1] Estimated; exact figures cannot be given until all work ordered is completed and billed.
[2] Does not include $25,000 transferred to the Civil Aeronautics Authority.
[3] Includes a deficiency appropriation of $24,417.93 contained in Public Act 361, Seventy-sixth Congress, approved Aug. 9, 1939.
[4] Amount available for printing not stated in appropriation item.

Receipts from sales of publications, other printed material, charts, maps, and processed statements issued by the Department of Commerce during the fiscal year 1939 were $726,514.73, as compared with $707,023.42 for 1938. The following table presents a comparison for the 2 years by selling agencies:

Sales	Receipts	
	1938	1939
By the Superintendent of Documents: Miscellaneous sales and subscriptions	$157,651.27	$171,414.76
By Coast and Geodetic Survey: Coast pilots, inside-route pilots, tide tables, current tables, charts, and airway maps	104,260.43	104,643.36
By Patent Office: Specifications of patents, reissues, etc., trade-mark section and decision leaflet of Official Gazette, and classification bulletins and definitions	396,724.40	404,349.50
By Bureau of Foreign and Domestic Commerce: Processed statements	48,387.32	46,107.11
Total	707,023.42	726,514.73

DIVISION OF PERSONNEL SUPERVISION AND MANAGEMENT

The Division of Personnel Supervision and Management was established on May 10, 1939, pursuant to Executive Order No. 79616 of June 24, 1938, replacing the former Division of Personnel.

A program has been formulated to establish the administrative and staff organization necessary to implement the provisions of the

President's order of June 24, 1938, and to provide in the Department of Commerce for progressive procedures and policies for such matters as selection, training, and placement of employees; competitive promotions; thorough investigation in connection with the classification of positions; the inauguration of welfare and recreation activities; equitable adjustment of grievances; and the fostering of proper personnel relations. However, the consummation of the program is dependent upon obtaining of additional funds from Congress.

There follows a statement showing the personnel of the various Bureaus of the Department as of June 30, 1939:

	Permanent	Temporary	Emergency
Office of the Secretary	154		
Bureau of the Census	845	593	9
Bureau of Foreign and Domestic Commerce	1,190	2	
National Bureau of Standards	948	1	
Bureau of Fisheries	909	20	23
Bureau of Lighthouses	4,417	1,140	
Coast and Geodetic Survey	1,300	69	
Bureau of Marine Inspection and Navigation	923	12	
Patent Office	1,357		
Total	12,043	1,837	32

During the past fiscal year, the following number of personnel actions were completed:

Appointments	892
Transfers	272
Changes in grade	734
Administrative promotions	1,908
Separations	658
Retirements	169

CONFERENCES AND EXPOSITIONS SECTION

The functions of this section include coordination of activities of all bureaus and agencies of the Department in connection with international conferences, expositions, and fairs and the performance of similar services in connection with local expositions in which the Department may be interested.

Pursuant to the provisions of Public Resolution No. 72, Seventy-fifth Congress, the Secretary of Commerce was charged with the responsibility for the Federal Government's participation in the Pan-American Exposition at Tampa, Fla., during January and February 1939. The Director of the Bureau of Foreign and Domestic Commerce was appointed Federal Commissioner, and this section handled the administrative work incident to the participation of 25 Federal departments and agencies.

During the fiscal year 1939, this Department was actively engaged in the development of Federal exhibits at the Golden Gate International Exposition in San Francisco and the New York World's Fair in New York. The Secretary of Commerce is chairman of the Federal Commission for United States participation in the Golden Gate Exposition and is a member of the Federal Commission for participation in the New York Fair.

The Department was active in the preparations for the Eighth International Conference of American States, Lima, Peru. The

Director of the Bureau of Foreign and Domestic Commerce was designated advisor to the American delegation. Delegates were nominated to attend the Third Pan-American Highway Conference, the International Congress on Planning and Housing, the International Congress on Photogrammetry, the Seventh World Management Congress, and the First Inter-American Travel Congress.

In addition to the international expositions, there were over 30 international meetings in the fields of commerce, education, finance, industry, law, and science in which the Department was interested. In some instances representative persons from pertinent professions or industries, or foreign commerce officers at conveniently located posts, were designated to represent the Department.

During the fiscal year 1939, the Department also was actively interested in over 20 local expositions varying in size and scope which were held in the United States, including the Chickamauga Centennial Exposition, Florida Industries Day, and Maritime Day.

Negotiations are now under way and plans are being developed for participation in such projects as the Seventh World's Poultry Congress and Exposition to be held at Cleveland, Ohio, from July 28 to August 7, 1939; the International Exhibition of Polar Exploration, Bergen, 1940; the International Forestry and Mountain Exhibition, Rome, 1942; and the meeting of the International Institute of Statistics, 1939.

OFFICE OF THE SOLICITOR

During the fiscal year ended June 30, 1939, there were 382 opinions rendered; the law and facts were reviewed in 28 cases of appeals to the Secretary of Commerce by officers and seamen of vessels from decisions involving the revocation or suspension of their licenses or certificates; the law and facts were reviewed in 73 cases involving petitions to the Secretary of Commerce for remission or mitigation of penalties for violation of the navigation and inspection laws; there were reviewed 202 cases submitted to the Attorney General; there were reviewed 85 cases for submission to the Comptroller General; and 213 contracts, 58 leases, 65 insurance policies, 10 revocable licenses, and 319 bonds were examined. Legislative matters handled numbered 180. In addition, 508 miscellaneous matters were handled.

All regulations issued by the Department and the Bureaus during the year were examined and approved. The office also reviewed the Federal Register work for the Department. Many other questions not requiring written opinions involving statutes, contracts, treaties, regulations, and administrative law and procedure were disposed of in conferences with officials of the Bureaus and representatives of other Departments.

BUREAU OF FOREIGN AND DOMESTIC COMMERCE

The fiscal year 1938–39 brought new opportunities for service and additional responsibilities, especially in the field of industrial economics, to the Bureau of Foreign and Domestic Commerce. At the outset of the year, Bureau participation in the Temporary National Economic Committee's work called forth the best efforts of the Bureau in marshalling and strengthening its research staff. Studies were initiated and materials assembled for hearings before the committee. This activity has taxed the resources of the Bureau severely, but the research personnel have, under great pressure, carried out their assignments creditably throughout the fiscal year.

The Bureau was recognized during the year by the appointment of its Director as a special expert on Latin American business and economics to represent the Department of Commerce and assist the Secretary of State at the Lima conference on pan-American affairs. The Director also was appointed United States Commissioner for the Pan-American Exposition held in February 1939 in Tampa, Fla.

Throughout the year the demands on the Bureau have multiplied, both for research and for service to American business at home and abroad. The recession in business of 1937–38 was responsible for many inquiries for assistance, especially from the smaller-scale business concerns. Every effort has been made to meet these demands with all of the resources of the Bureau. Demands have also been made on the Bureau by the Congress and other governmental agencies. The Bureau continued its cooperative activity on the trade-agreements program of the Administration. It cooperated with the Department of Agriculture on the program for disposal of surplus commodities through regular channels of distribution. Close cooperation with the Treasury Department was maintained in the collection of foreign-trade statistics. A cooperative arrangement was initiated with the Census Bureau in the collection of domestic-trade statistics.

An outstanding contribution was the first compilation and release of estimates of income by States as a part of the Bureau's program in the field of national-income research. Close cooperation was extended through the National Resources Committee to the States of Wisconsin and Minnesota on projects for estimating State incomes.

The Bureau also cooperated with a committee of deans of State university schools of business on proposed legislation designed to be of specific aid to small business through the establishment of business-research units in each State to be coordinated with the research program of the Department of Commerce.

CONSOLIDATION OF FOREIGN COMMERCE SERVICE WITH STATE DEPARTMENT

Following preliminary study and negotiation, the Foreign Commerce Service was transferred (effective July 1, 1939) by Executive order to the State Department and consolidated along with the Agricultural Foreign Service to form a unified Foreign Service of the United States under the direction of the Department of State. The Department of Commerce remains the organ of direct contact of the Government with the business interests of the country, while the consolidated Foreign Service, under the Reorganization Plan, will serve as the single instrument of all the departments and agencies of the Government interested in information from abroad, or any services outside the limits of the country. The preparation of instructions to the Foreign Service for the gathering of commercial and economic information and for trade work abroad will remain the function of the Department of Commerce.

A liaison officer representing the Department of Commerce will be stationed in the Department of State to enhance close cooperation between the two Departments and to facilitate the expeditious transmission of information from the foreign field to the Department of Commerce. A representative of the Department will also sit, when matters of commercial interest are concerned, as a member of the Board of Foreign Service Personnel, the Board of Examiners for the Foreign Service, and the Foreign Service Officers' Training School Board.

It is believed that the Reorganization Plan will eliminate any duplication of functions that may have existed in the past and will provide a more effective instrument for meeting the difficult economic problems brought about by present world conditions.

DISTRICT AND COOPERATIVE OFFICE SERVICE

The Bureau maintains 25 district and 8 cooperative offices located in the chief commercial centers of the United States. In addition, there are 46 offices affiliated with the Bureau through chambers of commerce which have established foreign-trade departments in charge of an officer of the chamber who represents the Bureau under the designation of foreign-trade secretary.

These domestic field offices are the direct and immediate points of contact at which the Bureau services are available to American commercial and industrial interests. They are the principal outlets through which information on both foreign and domestic trade reaches the business public. During the year the district and cooperative offices continued to disseminate in their respective districts official information from the Bureau in Washington on foreign exchange, credit conditions, trade restrictions, tariffs, and other factors affecting the sale of American goods in foreign markets. Distribution of foreign-trade opportunities for the purchase of American goods was of direct benefit to exporters.

In the domestic field the district offices cooperated closely with the Marketing Research Division of the Bureau in collecting information on various phases of domestic marketing of interest to those engaged in developing the market at home. They assisted in collecting data

for the Retail Credit Survey, which had a wider coverage than in any previous year. Their facilities were constantly used by sales executives in obtaining information to assist them in measuring the market for their products in specific areas, and they were frequently able to assist such executives in the solution of their problems by applying the data available at the district office. They worked closely with the United States Employment Service and provided the State directors of that service with information on fields for employment with a view to putting people back to work. They collaborated with the State directors of the National Emergency Council in disseminating a knowledge of the results achieved under the reciprocal trade agreements program of the United States, and in other ways they have cooperated with other departments in furthering the work of the Government in their districts.

ORGANIZATION OF BUREAU PROGRAM

The work of the Bureau is divided into two major groups or divisions, each under the supervision of an Assistant Director. One group deals with the trade-promotional and industrial-service activities of the Bureau. The other group includes the business-research and statistical work of the Bureau.

One of the Assistant Directors was appointed by the President as the representative of the Department of Commerce on the Committee on Purchases of Blind-Made Products. The purpose of the committee is to promote the Government purchase of goods made by blind persons. This is the first time the Government has organized its purchases of such products, and the committee's work has proved to be of great practical benefit to the blind.

TRADE PROMOTIONAL AND INDUSTRIAL SERVICE ACTIVITIES

According to the Bureau of the Census, all industry may be divided into approximately 350 classifications or 15 groups. For the past 17 years, therefore, the function of trade promotion has been sponsored in the Bureau of Foreign and Domestic Commerce through the medium of analogous commodity groups or industrial service divisions. This type of service for every branch of industry was made available during the fiscal year 1938–39 through business specialists in the following divisions:

Automotive-Aeronautics Trade.
Chemical.
Electrical
Foodstuffs.
Forest Products.
Leather and Rubber.
Machinery.
Metals and Minerals.
Motion Pictures.
Specialties.
Textiles.
Tobacco.
Transportation.

By virtue of their specialized knowledge and familiarity with the difficulties and problems of their respective industries, at home and abroad, these divisions were advocates of business and represented the interests and viewpoints of business in matters under consideration in the various agencies of the Government.

The perennial consideration of this group of divisions is: "How is business at home and abroad, and how may it be improved?"

Obviously the character of response is predicated upon the degree to which existing facilities permit determination. Since inception of the Bureau, coverage, of necessity, has been spotty. Basic studies are yet to be made for most branches of industry, and a large proportion of existing studies were made over 10 years ago.

The promotion-and-service program that was functioning during the year under review was formulated in part from suggestions embodied in the daily correspondence and in trade journals, from conferences with trade associations, advisory groups, and industrial leaders, and upon the basis of the visualized or expressed desires of other agencies of the Government.

Today there are few branches of industry that are not represented specifically by one or more trade associations and trade journals. Economy in Bureau functioning is manifest, therefore, by close cooperation with these more than 2,500 adjuncts to trade promotion. The primary interest of these bodies is statistics, and the industrial service divisions not only advise the Census Bureau periodically as to scope and composition of schedules but likewise inspire self-collection and dissemination of factual group data as well as statistical information by industrial components. In fact, in the year which has passed there was a gratifying increase in the number of firms which made periodic public release of such pertinent operation data.

Because of budgetary limitations, the industrial service divisions have not been able to respond favorably to certain requests for comparative surveys of domestic industry. A quarter of a century ago the dominant wish of industry was to develop markets abroad, and, throughout this period, organizational thought has been developed along this line. However, even in the field of foreign-trade promotion, the Bureau's existing staff is often heavily taxed to meet current service demands and visualized possibilities abroad. On the other hand, when we stop to consider that our total foreign trade represents the equivalent of only 10 percent of production, it should be realized that if the Bureau of Foreign and Domestic Commerce were to engage in domestic surveys analogous to our foreign-survey service, it would require a budgetary allotment many times that of the current year.

The work and accomplishment of the industrial service divisions throughout the year in developing markets for American merchandise in more than 100 foreign countries is indicative of domestic possibilities. Initially it should be borne in mind, however, that practically every type of article produced in the United States is found abroad and that the problems attendant upon foreign market investigations are more variable and no two market patterns are alike. Despite these complexities, the Bureau supplies monthly detailed records of shipments and purchases, pertinent to thousands of commodities, and, through the medium of research in Washington and abroad, reports are disseminated periodically (even weekly) as to the status of markets or sources and the effects of competition.

The consummation of such a service during the period under review has entailed the training of foreign observers through a prescribed course, the current revision of field reporting guides, and the dissemination of field letters, advisory as to new American developments. Annually a periodic field-reporting schedule is prepared, and

weekly one or more survey schedules or commodity questionnaires were dispatched to our foreign field offices as the basis of survey for such diverse products as: Road-making materials; fire-fighting equipment; safety glass; refrigeration; short-wave radios; 20 food items ranging from avocados to poultry products, and a number of chemical, leather, lumber, machinery, mineral, metal, paper, rubber, and textile products.

Upon receipt in the Bureau, this survey information as to production, distribution, and the opportunity for American participation was disseminated in the form of press releases, informational circulars, Commerce Reports, or through one or more of the two dozen periodic bulletin services. If warranted, the entire world picture is presented in the form of a printed bulletin. Outstanding printed publications issued by these divisions during the year were the following:

Synthetic Organic Chemicals.
Foreign Markets for American Medicinals.
World Chemical Developments in 1938.
Foreign Directories.
Foreign Selling Outlets.
Fruit Canners of the World.
American Wooden Boxes and Crates.
American Southern Pine.
American Southern Cypress.
American Hardwood.
Folding Paper Boxes.
Make It of Leather.
Rubber Industry in United States, 1839–1939.
World Trade in Toys.
World Trade in Dental and Surgical Instruments.
Transport Control Aboard.

Aside from basic surveys, there are several hundred key commodities of commerce, primarily exotic products, upon which periodic data are currently received on schedule from abroad; for example, the medicinals—camphor and menthol; drying oils—tung and linseed; paint gums—shellac and copal; foodstuffs—coffee and sugar; metals—copper and tin; minerals—asbestos and manganese; fertilizer—potash and nitrate; and others such as hides, pulp, rubber, and silk. In addition to the foregoing, there has been a growing demand for the annual statistical reviews of United States trade in these products, which were released by the industrial service divisions this year, 6 months prior to the availability of the printed official annual Foreign Commerce and Navigation of the United States.

Each of the 13 industrial service divisions issues from 1 to 5 weekly or monthly processed news services. This news, the statistical statements, commercial-intelligence reports, and survey bulletins are the backbone of Bureau service to foreign traders, and approximately 50,000 firms are subscribers or regular recipients. However, five times as many firms were intermittent seekers of aid during the year through correspondence, telephone and telegraph, or personal contact with these divisions and our district offices. To serve efficiently this number, the divisions prepared numerous commodity informational synopses, bibliographies, reading references, and trade lists.

Through the medium of the Commercial Intelligence Division approximately 250,000 American firms, or 50 percent more than in the previous year, were furnished with 6,760 foreign-trade opportunities, 44,149 trade lists, 48,881 sales-information reports on foreign firms;

and the wants and itineraries of 912 foreign businessmen visiting the United States were chronicled.

A phase of service of these divisions which is expanding is the feature of consultation. Aside from contact with our district offices, more than 10,000 businessmen visited the industrial service divisions in Washington during the year to present their problems in detail. Such discussions covered a wide range, involving counsel as to new processes, research fields and commodity uses, contemplated patent action, refinancing, mergers, cooperative concepts, and a host of considerations as to advertising, distribution, and other promotional projects.

An even more fertile field, which, however, has been but sparsely cultivated, is the realm of group consultation. This opportunity is presented through the annual conventions and other periodic meetings of the trade associations. In some instances, it should be noted, such meetings are attended by Bureau representatives at no cost to the Government. Last fall the National Foreign Trade Council prevailed upon the Bureau to experiment with eight industrial division chiefs as group counselors at the annual Foreign Trade Convention, and the success of the project warrants acceptance of the council's invitation to the forthcoming session. Of special significance was the conference of the National Electrical Manufacturers Association held in the auditorium of the Commerce Building and worked out with the close cooperation of the Electrical Division.

Another indication of the value of group action is the growing response of communities throughout the country to Foreign-Trade Week, sponsored by the United States Chamber of Commerce and participated in by our district offices and a number of promotional specialists in Washington. Counsel was rendered many of the individual Members and committees of both Houses of Congress, and service sought by other Government agencies has been recorded for 30 Bureaus in the 10 executive departments and 29 independent United States agencies—administrations, boards, commissions, committees, and corporations. One industrial service division alone had 375 such references in the course of the year. In some instances specialists of these divisions have been members of interdepartmental committees or of informal Government gatherings designed to deal with problems of a specific character. In still other cases, a division may have sponsored a mixed grouping of trade and Government counselors for a guiding, though possibly nonbinding, discussion of business principles or concepts.

Counsel was sought by foreign governments, foreign government trade missions, scientific and related delegations, which agencies quite generally sought initial guidance from these industrial service divisions. In fact, a group of university students from Chile were so aided in recent months, and this may be the forerunner of similar groups from other Latin-American countries.

Foreign-trade dislocation during this fiscal year, in consequence of war scares and racial discriminations, involved these commodity divisions in world surveys as to new sources of materials, evaluation of substitutes, and more intensive investigation of new or minor markets. Refugees at home and abroad have likewise sought guidance with respect to readjustment.

A decided trend has been apparent on the part of industry and entrepreneurs who seek promotional advice requiring a high degree of technological as well as economic and marketing experience on the part of the Bureau's specialists in the industrial service divisions. The necessity for such knowledge is particularly evident in considering problems involving synthetics, substitutes, and subnormal-grade raw materials; patent exploitation, process licensing, and new uses; new commodities in commerce, waste utilization, and the production control of coproducts; formulation of suggestions in the field of commodity standards, simplification, and elimination of varieties. Such knowledge was likewise sought by such Government agencies as the State, War, and Navy Departments on strategic raw materials, Treasury Procurement service specifications, Agriculture's Surplus Commodity Corporation, and many others, including the Congress. Incidentally, such problems most frequently involved a high degree of interdivisional cooperation.

FOREIGN-TRADE ZONES

The Bureau is responsible for much of the work of the Foreign-Trade Zones Board, of which the Secretary of Commerce is chairman and executive officer, and on which the Secretaries of the Treasury and of War serve as members. The chief of the Transportation Division of the Bureau is executive secretary of this board and is responsible for surveying the applications for Foreign-Trade Zones, including the conduct of field investigation prior to the issuance of grants to operate such zones. The annual report of the Board to Congress is also prepared in this Bureau.

INDUSTRIAL ECONOMICS ACTIVITIES

The domestic-commerce program of the Bureau was reorganized during the year. A new Division of Business Review was set up to concentrate on current business problems and general business conditions. Units were transferred from the Economic Research and the Marketing Research Divisions to form the new Division, thus consolidating related activities in the new Division and facilitating more effective administration and better service to business and other departments of the Government. At the same time, the two research divisions were organized for concentration upon more fundamental research into economic and marketing problems in such important fields as construction, national income, and distribution costs. The new arrangement further facilitated concentration of research energies on the responsibilities of the Bureau with respect to the Temporary National Economic Committee.

The research and statistical activities in the field of industrial economics under the Assistant Director in charge fall into two natural groups, domestic commerce and foreign commerce.

DOMESTIC COMMERCE DIVISIONS

Special activities.—The domestic-commerce activities are conducted in three divisions: Business Review, Economic Research, and Marketing Research. In addition to the routine work, each of these Divisions has cooperated with the Temporary National Economic Com-

mittee by conducting special studies, assembling facts, and preparing reports for the use of the committee. In particular the Division of Business Review has conducted a study of export price policies and another on the changes in the size of manufacturing establishments. The Economic Research Division has carried out projects on the character and scope of the construction industry, on corporate policies and practices as revealed by financial statements, on the structure of industry, on taxation of economic enterprises, and on trends in income by industrial sources, types of payment, and size of income. The Marketing Research Division has conducted an extensive survey of trade associations, has studied business population, trade barriers, trade practices, and the effect of size on manufacturing and distribution costs.

Among the reports issued by the domestic commerce divisions are the new 1939 edition of the Consumer Market Data Handbook and the first edition of the Industrial Market Data Handbook, prepared in the Marketing Research Division; State Income Payments, 1929–37, the first official estimates of annual income payments in each of the 48 States and the District of Columbia; Residential Building, an economic analysis of the building industry, including new statistical series measuring demand factors; and Trend of Long-Term Debts in the United States, 1934–37, prepared in the Economic Research Division.

Various staff members of these divisions have participated actively on interdepartmental committees, including Central Statistical Board, National Resources Committee, Central Housing Committee, and committees on the Census of 1940. Particular note is made of the cooperation which the Marketing Research Division rendered the Department of Agriculture in formulating the "stamp plan" for distribution of surplus agricultural products through existing trade channels.

OUTSTANDING DEVELOPMENTS IN DOMESTIC BUSINESS AS REVEALED BY DOMESTIC COMMERCE RESEARCH

The past fiscal year was one of improvement in domestic business, but, as it followed a year of contraction and found most enterprises searching for ways and means to improve their position in a market of reduced proportions in comparison with predepression or even with 1937 experience, constant reappraisals by business and government for the purpose of furthering economic progress were essential. The facilities of the domestic-commerce divisions were directed to the end of meeting the problems created by the shifting economic scene by (*a*) direct assistance to businessmen and to other Government agencies, as well as by (*b*) contributing factual studies designed to foster a better understanding on the part of both business and government of the fundamental operations of the economic system.

The decline and subsequent rise in business during the past 2 fiscal years focused attention on the fluctuations of the Bureau's monthly index of income payments, and, to an increasing extent, this came to be used as a measure of consumer purchasing power. Since the original purpose of constructing the index was to provide a current series comparable with the annual estimates of income paid out, the index was deficient for the major purpose for which it was being used.

Consequently, a general revision was made so that the series more closely approximated the cash or disposable income flowing to individuals.

Intensification of marketing research, with its concomitant demand for more adequate regional marketing information, was fostered by several major studies completed during the year. One of these, prepared in the Marketing Research Division, made available for the first time, in condensed though comprehensive form, data on industrial markets for each of the 3,071 counties in the United States. Supplementing this and other studies from the marketing standpoint, but of broad general application, were the first official estimates of income payments, by States, broken down by types of payment, prepared by the Division of Economic Research. The Bureau hastened completion of these estimates in order that the results of its research might be available to the Social Security Board and to the Congress when considering revisions of existing legislation to which the problem of income distribution, by States, was basic.

The reverse of the flow of funds as income is the measure of consumer outlays to determine whether the income is flowing promptly back into business channels. In the absence of a direct measure of this flow, the Bureau has for the past several years been extending its sample of retail-sales data for the purpose of obtaining eventually a comprehensive picture of retailing on a national and regional basis. The data were developed in the Marketing Research Division during the past year to a point which permitted the issuance for the first two quarters of the current calendar year of estimates of the total dollar volume of retail sales, with comparative data for the major types of retailing. These estimates revealed an increase of a billion dollars, or 6 percent, in the value of retail sales in the first half of the calendar year 1939 over the corresponding period of 1938.

As is usual in periods of declining sales and income, credit problems have engaged increasing attention. The abrupt drop in sales of consumer durable goods after the middle of 1937 raised a question as to whether liberalization of installment terms during the period of rising business volumes and the tendency to reverse such policies during a period of declining trade had not exerted an important influence on the extent of business contraction which actually took place in 1937–38. A study of this situation by the Marketing Research Division developed the conclusion that, while restriction of terms probably did not reduce sales to an important extent, liberality during the earlier rising phase of business had contributed to the subsequent reduction in the demand. A further contribution to the factual data available in this general field was the first annual survey of bad-debt losses made jointly by the Bureau and the National Association of Credit Men. The Economic Research Division brought up to date its measures of the volume of long-term debts, revealing a further contraction of about 4 billion dollars, or more than 5 percent, in the total of private long-term debts outstanding during the 3-year period 1934–37.

Because of the central place which it occupies in any program of economic stimulation and the added study given this area of our economy by the Temporary National Economic Committee, the Division of Economic Research brought to completion certain research projects designed to provide a better understanding of the funda-

mentals of the construction industry. The principal project in this field was the study of the major economic factors influencing the volume of residential construction, prepared by the Bureau for the National Resources Committee. One of these factors, to which special attention was given, was the measurement of vacancies in a number of principal cities throughout the United States. A revision of the estimates of the total volume of construction activity was completed and made current through 1938.

As a further contribution to the study of the role of the durable-goods industries in cyclical fluctuations, the Bureau undertook to supply the necessary basic data on certain phases of the flow of investments and savings. The Division of Economic Research undertook an analysis of the financial statements of large and small corporations for the Temporary National Economic Committee for the purpose of determining the source of funds flowing to business enterprises from various channels and the use or disposal of funds by corporations. Emphasis in this study is being placed on capital expenditures and their relationship to depreciation, security flotations, earnings, liquidity, and other factors. Also, an analysis has been initiated for the purpose of bringing together and analyzing available data on the distribution of income by size. The character of the distribution of income in recent years, as well as the changes or absence of change in the concentration of income, is being subjected to careful analysis.

The Bureau has as a matter of policy directed much of its efforts to helping small business, providing through the Division of Business Review in "Domestic Commerce" and the "Business Information Service," and through other units, a service to the smaller business entities which are not in a position to provide such data and guidance from their own resources. The proposals for cooperative research with the State universities above mentioned have, as a basis, the direction of further efforts into these channels, designed to aid in the solution of the operating and general problems confronting the businessman of limited resources.

One of these—the condition in which the wholesale grocery trade finds itself, with the prevailing price structure intensifying the problem of how to move the existing tonnage on a profitable basis—has occasioned the first field survey which the Bureau has undertaken in several years. The Marketing Research Division, which is carrying on this work, also initiated the preparation of a handbook on distribution cost accounting which will be found useful in guiding efforts to produce profits through more adequate budgetary control.

FOREIGN TRADE RESEARCH AND STATISTICS

Special activities.—A group of five divisions (Commercial Laws, Finance, Foreign Tariffs, Regional Information, and Foreign Trade Statistics) provides the basis for much of the Bureau's most highly technical service to America's international traders. The routine activities of these divisions occupy a large share of the time of their personnel. Special services have, nevertheless, been rendered during the past fiscal year, notable among which was the contribution to the Temporary National Economic Committee by the Regional Information Division of studies of the problems of economic con-

centration and of fundamental economic changes in certain foreign countries. The focusing of interest on Latin America in the Lima conference called forth the best efforts of Bureau experts in the divisions of Regional Information, Finance, Foreign Tariffs, and Commercial Laws, both in preparation for the conference and in meeting subsequent demands for information and guidance in formulation of governmental and business policy.

A publication of unusual interest, Oversea Travel and Travel Expenditures in the Balance of International Payments of the United States, 1919–38, was issued by the Finance Division. The Regional Information Division found a brisk demand for two bulletins entitled "Commercial Traveler's Guide to Latin America," covering the west and the east coasts of South America, which necessitated reprinting. Complete also in this Division was a study of The United States' Place in India's Trade and several studies of living costs for Americans in selected foreign lands. Noteworthy among the publications of the Foreign Tariffs Division were Foreign Marks-of-Origin Regulations, Taking Your Car Abroad, and Preparing Shipments to British Countries, all of which are of great value to American exporters.

The growing interest in interstate trade barriers called forth a special contribution from the Commercial Laws Division, which, in cooperation with the Marketing Research Division, enabled the Bureau to participate in a number of conferences dealing with this menacing problem. The Finance Division was called on for special service as a result of the avalanche of inquiries from small business, a large proportion of which dealt with the need for financial assistance.

The Division of Foreign Trade Statistics consolidated its gains of the previous year in speeding the publication of current export and import statistics. Special tabulations were prepared for such outstanding events as the Lima conference. The changing status of Czecho-Slovakia called for special tabulations as well as for revision of the statistics to provide a basis for the imposition of the customs duties under the new German auspices.

OUTSTANDING DEVELOPMENTS IN FOREIGN TRADE AS REVEALED BY FOREIGN-TRADE RESEARCH

Evident signs of recovery in world trade appeared in the statistics of foreign trade compiled by the Bureau during the second half of 1938, coincidental with the upturn in industrial activity in the United States. During the year as a whole, the value of world trade was reduced as a consequence of declines in both the quantity and the prices of internationally traded goods. Developments in the foreign trade of the United States were of profound, and in some respects determining, influence on world commerce. Exports from this country to the rest of the world were only slightly smaller in value in 1938 than in the preceding year, and remained above the level of any other recent year since 1930. Imports, on the contrary, were reduced in value by more than a third. As a result of these disparate changes, the share of the United States in world trade in 1938 rose moderately in the case of exports but dropped substantially in the case of imports. The export trade balance of the

country exceeded a billion dollars, the largest margin of exports over imports in 17 years. Other outstanding features of the international commercial and financial transactions of the United States during 1938 revealed by the research of the Bureau were the greatly reduced net payments to foreigners for various services as compared with 1937, a continued movement of capital funds from abroad, and a further heavy inflow of gold.

The decline in United States imports of merchandise in 1938 (which accounted for nearly one-third of the decline in world import trade and for about one-half of the fall in trade in raw materials) reflected a reduced demand for foreign crude materials growing out of the slackening of industrial activity in the last half of 1937, on the one hand, and abundant domestic supplies of certain agricultural products replacing previous shortages, on the other. After the middle of 1938, domestic requirements for imported materials began to increase along with the general improvement in business. At the same time, the decrease in the prices of goods in world trade was arrested, and there followed a normal seasonal expansion in the quantity of trade. In general, exports of United States merchandise were fairly well maintained in 1938. The demand for American aircraft, machinery, and metal manufactures continued strong, partly because of the requirements of rearmament programs in several European countries; and foreign sales of crude and manufactured foodstuffs were considerably increased despite a marked decline in shipments of raw cotton.

The obstacles to foreign intercourse, which became perhaps even more numerous and more complex during the past year than in preceding years, have imposed heavy burdens on the Foreign Tariffs and Finance Divisions. Much research has been necessary to provide timely and adequate information for the guidance of American foreign traders. Various forms of exchange restrictions imposed by foreign governments have created a problem of obtaining effective payments in dollars quite apart from the ordinary difficulties of securing and holding foreign markets for American products. Not only are restrictions placed upon the free conversion of foreign currencies into dollars, but it may be required also that exchange allotments must be obtained before goods are passed through customs or even before goods are ordered. Imports from the United States are frequently on a different footing from shipments originating in other countries, notably in instances in which clearing and compensation agreements are in effect or in which bilateral trade results in an excess of exports from this country; and special regulations are sometimes applied to the importation of particular commodities. Transfers of dividends, profits, royalties, and other payments not directly related to trade in goods are often subject to rigid controls. Morever, the operations of American-owned enterprises in certain foreign countries, involving investments of large proportions, have been placed under severe disabilities.

In the case of barriers to trade in goods, there has been increasing resort to measures beyond the familiar tariff duties. For example, quota systems which stipulate maximum quantities of specified commodities which may be imported from all countries, or from desig-

nated countries, or even by individual importers, have become common. It is a matter especially worthy of note that the restrictions imposed upon international trade and payments constitute no settled order which can be satisfactorily analyzed or summarized at infrequent intervals. Since changes in regulations are generally made by the administrative action of authorities acting under broad discretionary powers, changes may be literally daily occurrences. The situation has been rendered the more confusing during recent times by political dislocations in Central Europe and Asia and by the formation of trade areas and currency blocs to which access from outside areas is completely or partially closed by the use of extraordinary control devices.

These developments in foreign commerce have emphasized the importance of the informational and research activities of such divisions of the Bureau as Foreign Tariffs, Regional Information, Finance, Foreign Trade Statistics, and Commercial Laws, on the one hand, and the Bureau's participation in the trade-agreements program through its Trade Agreements Unit, on the other. Individual firms and financial institutions are often entirely unable to cope with the new problems arising in the conduct of foreign trade. New forms of competition in the foreign market, new and formidable obstacles to trade, and frequent interferences with the free flow of international payments have made it imperative that American business and finance be kept advised on day-to-day developments in the field of trade and exchange restrictions. This service has aided not only in the maintenance of foreign trade; it has prevented also serious losses which would otherwise have resulted from the failure of exporters to secure clearance of shipments by foreign customs and exchange authorities or to receive payments from foreign purchasers promptly or at all.

Since under present-day circumstances knowledge of detail is often meaningless without knowledge of the whole, the broader research activities of the Bureau in the realm of foreign commerce have gained added significance. Businessmen and bankers have been assisted very materially in the management of their affairs in other countries through the careful, comprehensive analysis by the Bureau of general economic and financial conditions abroad, as well as of developments in the trade and financial relations between the United States and foreign countries. The grateful acknowledgment on the part of the business and financial community of the assistance rendered by the Bureau is the best indication of the successful performance of this function. The Bureau has clearly played a major role in maintaining and extending a foreign trade which occupies an obviously important, and in many industries a primary, place.

The results of the trade-agreements program, in which the Bureau actively participated, became increasingly significant during the past 12 months. By virtue of the conclusion of agreements with the United Kingdom and the British Crown Colonies, with Ecuador, and with Turkey, the 19 countries with which reciprocal agreements are in operation, together with their colonies, account for approximately 60 percent of the total foreign trade of the United States.

APPROPRIATIONS

Salaries and expenses, Washington Commerce Service	$543,800
Domestic Commerce, Department of Commerce	330,000
District and cooperative office service, Department of Commerce	323,000
Export industries, Department of Commerce	530,000
Salaries and expenses, Foreign Commerce Service	764,500
Customs statistics, Department of Commerce	403,000
Transportation of families and effects of officers and employees and allowances for living quarters	143,800
Received by transfer from "Foreign Service pay adjustment, appreciation of foreign currencies"	100,000
Total	3,138,100

PERSONNEL

	Employees on roll June 30, 1939		
	District of Columbia	Field	Total
Permanent	588	577	1,165
Temporary	7	0	7
Total	595	577	1,172

BUREAU OF THE CENSUS

INTRODUCTION

During the past year the Bureau of the Census has faced the dual task of maintaining current work and also preparing for the decennial census of 1940. The preparatory work, already well under way at the beginning of the year, has been accelerated until it has become the major task of the Bureau.

The Sixteenth Decennial Census will serve all the people of the United States. It will collect pertinent social and economic information from every State of the Union as well as Alaska, Hawaii, Puerto Rico, Guam, Samoa, the Virgin Islands, and the Panama Canal Zone.

The increasing complexity of modern life has placed more demands upon the Bureau to extend its field of inquiry. The counting of population in each State to serve as a basis for representation in Congress is provided for in the Constitution. Now, by far a greater task is to obtain data on the characteristics of the population and the social and economic activities of their daily life. A comprehensive picture of social and economic conditions existing on the date of enumeration and of activity for the preceding year will be presented. Such a wealth of facts will be available that the publication and interpretation of the figures will require about 3 years to complete.

A decennial census requires personnel, equipment, and space nearly 10 times that needed in noncensus years. The preliminary planning necessary to train 150,000 people, to tabulate 500 million punch cards, and to publish, with extreme care to avoid errors, more than two score volumes of statistical tables has occupied a large proportion of the Bureau's time during the year.

The trend toward mechanization of statistical work is very marked. In making plans for a new census, considerable time and study is being given to the development of new tabulation devices which decrease costs and eliminate errors. The tempo of the times is such that information rapidly loses value as its age increases. The Bureau is making every effort to increase the timeliness of its publications, and has succeeded in setting several records during the past year.

Methods are being developed for improving the general level of efficiency of the personnel of the Bureau by means of in-service training. Educational opportunities have been provided and employees encouraged to make use of such facilities. Preliminary preparations have been made for training approximately 7,000 new employees in the District of Columbia office and 140,000 field workers. The training of field enumerators is of very great importance. The quality of the published data depends upon the accuracy and efficiency with which the enumerators do their job.

The Bureau has also studied suitable methods of meeting the increased demand for current statistics. Particular attention has been paid to suggestions for improving the coverage of industries now regularly reporting and to a widening of the fields of inquiry.

Legislation.—The Sixteenth Decennial Census will be taken under authority of "An Act to provide for the fifteenth and subsequent decennial censuses and to provide for apportionment of Representatives in Congress," approved June 18, 1929, 46 Stat. 21. An act approved August 11, 1939, provided for a national census of housing to be taken in 1940 in conjunction with and as a part of the population inquiry of the Sixteenth Census.

Three bills were introduced in Congress for the purpose of correcting the anomalous situation in the present law relating to the apportionment of Representatives in Congress, created by the twentieth amendment to the Constitution. The amendment changed the beginning date of the regular sessions of Congress from December to January. This creates an absurdity in the apportionment law because the President would be required to report to the third session of the Seventy-sixth Congress within 1 week after its opening on January 3, 1940, the results of a census of population which will not be taken until April 1, 1940. A bill (H. R. 50) was introduced providing for the monthly collection of statistics on the production of certain vegetable oils, oil cake, and meal, etc. None of these bills had received final approval at the close of the first session of the Seventy-sixth Congress.

Advisory committee.—The Bureau makes a constant effort to keep in touch with the recent advances and demands for data in fields of work covered by its inquiries. The knowledge and advice of eminent experts in all fields of our social and economic life are required to accomplish this objective. To this end a general advisory committee is appointed by the American Statistical Association to advise the Director of the Census. In addition, special advisory committees are invited to serve by the Secretary of Commerce upon the recommendation of the Director of the Census for the purpose of advising the chiefs of the various divisions on subject matter pertaining directly to the work of these divisions. In the sections of this report relating to these subjects the personnel of these committees is listed. The work of the special committees is coordinated by the general advisory committee.

The present membership of the general Census Advisory Committee is as follows:

ROBERT E. CHADDOCK, Columbia University, New York City, chairman.
MURRAY R. BENEDICT, College of Agriculture, University of California, Berkeley, Calif.
PAUL T. CHERINGTON, New York City.
FREDERIC J. DEWHURST, Twentieth Century Fund, New York City.
WILLIAM F. OGBURN, University of Chicago, Chicago, Ill.
WILLARD L. THORP, Dun & Bradstreet, Inc., New York City.

The work of the regular advisory committees was supplemented with the advice of representatives of private organizations and other governmental agencies. A series of conferences was held during the year. Interested persons were invited to express their viewpoints and desires and to make recommendations concerning the material to

be included in the 1940 census schedules. The Bureau feels that these meetings have made important contributions toward the improvement of the Sixteenth Decennial Census.

PREPARATION OF ENUMERATION DISTRICT DESCRIPTIONS AND MAPS

Through correspondence with local officials the necessary information concerning changes which have occurred in the boundaries of counties, townships or other minor civil divisions, cities, and wards in cities has been secured, and from the various State highway departments and other sources approximately 2,400 new county maps have been obtained.

The work of laying out the enumeration districts has been completed for about one-third of the counties of the United States, although the duplicate maps for the use of the supervisors and enumerators have not been prepared for all these counties. The enumeration district descriptions and duplicate maps have been completed for the enumeration of Alaska, which will be started prior to the census of continental United States.

Census tracts.—Owing to pressure of the preparatory work in connection with the census of 1940, the Bureau was forced to set a deadline for the establishing of tract areas and no tract proposals have been accepted since September 1, 1938. On that date tracts had been established in 59 cities, and for 24 of these cities tracts in the surrounding area had also been delimited.

Metropolitan districts.—The special committee appointed to consider the question of metropolitan districts has been working on the subject, but final recommendations have not been transmitted to the Bureau. The committee anticipates that its work will be completed in the early part of the coming fiscal year. The metropolitan district committee is composed of Paul T. Cherington of New York City, representing marketing and advertising interests; T. W. Howard of the Chamber of Commerce of the United States, representing manufacturers and chambers of commerce; and Glenn E. McLaughlin, Bureau of Business Research, University of Pittsburgh, representing other statistical groups.

Delimitation of unincorporated urban places.—The work of delimiting the larger unincorporated urban places has been continued during the past year by the Bureau of Public Roads, working in cooperation with the Bureau of the Census. Limits have been set for these places in 29 States, which boundaries will be followed in enumerating the areas at the census of 1940.

QUINQUENNIAL CENSUS OF AGRICULTURE

The preliminary trial of the agricultural census schedule which was made to determine the relative effectiveness of the various questions, the time required, and the difficulty in obtaining satisfactory replies was mentioned in the last report.

The tabulation of the data disclosed some very interesting and helpful facts which were used as a guide in drawing up and determining the schedule for 1940.

The actual selection of questions for the schedule was made with the advice of a committee composed of the following members:

S. H. DEVAULT, American Farm Economic Association, chairman.
W. F. CALLANDER, U. S. Department of Agriculture.
W. R. OGG, American Farm Bureau Federation.
FRED BRANCKMAN, The National Grange.
HAROLD F. E. JEUNET, Agricultural Publishers Association.
H. G. KEENEY, Farmers' Educational and Cooperative Union of America.
OLE A. NEGAARD, Central Statistical Board.
W. B. JENKINS, Bureau of the Census.

Their recommendations were reviewed by the Census Advisory Committee after which the schedules were prepared. The agricultural committee considered the thousands of questions submitted by various departments, organizations, and interested persons.

A special plantation schedule was also prepared to accompany the general farm and ranch schedule. In addition, two schedules for irrigation and one for drainage were completed by a different committee made up of representatives of the Departments of Agriculture and Interior and the Bureau of the Census.

Among other preparations for the census was a cooperative campaign to induce farmers to keep records. The experience secured from the canvass with the trial schedule indicated that only a very small percentage of farmers kept books. Those who did were able to answer the questions accurately and readily. The others required much more time and study. In this campaign the Extension Service of the Department of Agriculture and the Office of Education of the Department of Interior rendered very great assistance. Federal statisticians of the Crop Reporting Service went directly to their more than 100,000 crop reporters; vocational teachers reached a very large number of students, and through them, the farm families; and county superintendents of schools brought the matter to the attention of the country-school teachers. Further valuable assistance was rendered by country bankers, county clerks of court, county commissioners, and librarians. Altogether some 300,000 persons were reached directly by these means, exclusive of many times that number reached by the farm papers and the radio broadcasts. This campaign will be continued until the time of taking the census. Particular emphasis will be placed on keeping records of crop and livestock production for the calendar year 1939, with extensions to April 1, 1940.

Technical and mechanical preparations included a study and review of all processes of the office work from the time the schedules are received, through the editing and tabulating of the data to the analysis and publication of the results. The study has already resulted in a number of improvements which should increase both the speed and accuracy of the work.

Going beyond the preliminary stages, work upon the comparative results from the 1935 and 1930 censuses is well advanced. The summaries for 129 of approximately 200 items on the schedule have been completed.

The most important special study of 1935 census data was the size of flock tabulation for chickens and eggs made in cooperation with the Department of Agriculture. This tabulation provided information which was in demand and at the same time served to establish mechanical methods and procedures for the coming census. Methods

of changing groups for comparative purposes and the preparation of summary cards for simplifying and expediting the work were investigated.

The study of the summaries of editors' and reviewers' reports for 1930 and 1935 brought to light many interesting facts, one of which was the advisability of using mechanical methods to eliminate hand coding.

DECENNIAL CENSUS OF POPULATION

At the close of the year preliminary schedules, instructions, and other forms for use in the enumeration of the population had been prepared. These forms are to be tried out in a special census of St. Joseph and Marshall Counties, Ind. The special census will be taken as of August 14, and will be of great assistance to the Bureau in determining whether any change is necessary in the schedules or the instructions.

Two alternative forms of the population schedule are to be used in the special census—a "regular" schedule carrying lines for 100 names and a household schedule with space for 12 persons. The "line" schedule will be used in one-half of the districts and the "household" schedule in the other half. In addition, a supplementary population schedule will be used in the enumeration of every tenth household, thus providing the basis for a sample study of important information which could not be included on the regular schedule. Provision has been made, also, for checking the completeness of the enumeration of children under 1 year of age by the use of an Infant Report Form.

Suggestions concerning inquiries to be included on the population schedule were received from a large number of individuals and organizations. These questions were given full consideration at a conference of representatives of business, industry, labor, and other interested groups. A tentative schedule which had been prepared in advance served as a basis for the general discussion of subjects to be included at the coming census. A revised draft of this schedule was prepared for the consideration of the general Census Advisory Committee.

A technical standing committee was appointed to serve in an advisory capacity. Six meetings were held during April, May, and June. The members of this committee included:

Frederick F. Stephan, American Statistical Association, chairman.
O. E. Baker, U. S. Department of Agriculture.
Frank Lorimer, American University.
P. K. Whelpton, Central Statistical Board.
Howard B. Myers, Work Projects Administration.

A committee composed of the statistician on occupations and special representatives of several other governmental agencies was engaged for several months during the year in the preparation of a standard classification of occupations. The final draft of the classification is now in process.

Work has also been done on certain comparable 1930 data for publication with the 1940 census. Part of this work consisted in the consolidation of the urban, rural-farm, and rural-nonfarm figures for counties. At the close of the year it had been completed for over one-half of the counties.

In connection with the preliminary work of the Sixteenth Census, a special study is being made of differential fertility in Butler County, Ohio. Dr. Warren S. Thompson of Scripps Foundation for Research in Population Problems is cooperating in this special study. This investigation will provide an opportunity for experimental work on tables which may be used for the family statistics of the 1940 census.

As a part, also, of the preparatory work a type-of-family analysis has been made of the 1930 data. This analysis will aid in determining the advisability of making similar tabulations in 1940.

HOUSING

In order to provide information concerning the number, characteristics, and geographical distribution of dwelling structures and dwelling units, the Director of the Census was authorized by Congress to take a census of housing throughout the United States, Hawaii, Puerto Rico, the Virgin Islands, and Alaska. This census is to be taken as of April 1, 1940, in connection with the population inquiries of the Sixteenth Decennial Census. All of the confidential features of the regular census inquiries are applicable to the questions relating to housing.

The act authorizing the housing census was approved shortly after the close of the fiscal year, and preparations for this census are being started. The housing census will probably make desirable a number of modifications in the present preliminary schedules for population and agriculture, in order that the three inquiries may be coordinated. Preparatory work on the census of housing has just been started, although some extended thought has been given to this census in anticipation of its authorization by Congress.

BIENNIAL CENSUS OF MANUFACTURES, 1939

Conferences on revisions of the schedules to be used in the 1939 Census of Manufactures were held with representatives of industry, trade associations, manufacturers, and other governmental agencies during March, April, and May. At the close of the fiscal year revised schedules and instructions to enumerators had been completed and transmitted to the Secretary.

The uniform industry classification, which had been in preparation by an interdepartmental committee during the last 2 years, was adopted on June 1, 1939. The new classification provides for 20 major groups of industries and for approximately 430 separate industry classifications. This represents a very definite forward step toward improving the industrial statistics, as it will provide for comparability with statistics collected by other governmental agencies and will fit the statistics more realistically into the pattern of our present industrial structure.

CENSUS OF MINES

The 1939 Census of Mines is as yet in a formative state. Schedules for this inquiry will be drawn up in close cooperation with business interests and other governmental agencies, especially with the Bureau of Mines of the Department of the Interior.

BUSINESS

In preparation for the 1939 Census of Business, a card list based on establishments in operation in 1935 was started. The master lists are arranged by coded areas—States, counties, and cities—while the field list is arranged by enumeration districts and is to be used in the canvass. The retail establishment card file, numbering over 1,650,000 cards, has been completed. It is planned to complete the wholesale establishment list of over 170,000 cards before the enumeration. A list for the construction industry is also contemplated. The purposes of such lists are to establish a control of the classification of establishments and to insure a more complete enumeration.

During the months of April, May, and June, numerous conferences were held for the purpose of determining inquiries to be included in the questionnaires for the 1939 Census of Business. Fourteen schedule forms were prepared covering retail and wholesale trade, service establishments, places of amusement, hotels and tourist courts, and the construction industry as carried on by general contractors, subcontractors, and operating builders.

TERRITORIES AND INSULAR POSSESSIONS

The schedules and enumerators' instructions required in the census of Alaska, to be taken as of October 1, 1939, were prepared and sent to the Government Printing Office. Tentative drafts of the schedules and instructions for use in the censuses of the other outlying areas of the United States, to be taken as of April 1, 1940, were prepared and submitted to the Secretary of Commerce.

The population censuses of Alaska, Hawaii, Puerto Rico, the Virgin Islands, and the Panama Canal Zone will be similar to but slightly less detailed than the population census of the continental United States. For Guam and American Samoa the schedules used will be considerably less comprehensive in their coverage. Agriculture will be canvassed in Alaska, Hawaii, Puerto Rico, the Virgin Islands, Guam, and American Samoa, and short schedules will be used for manufactures and business in Alaska, Hawaii, and Puerto Rico.

PREPARATION AND REVIEW OF SCHEDULES

All of the schedules for the various inquiries of the 1940 census have gone through a number of drafts and revisions. The advisory committees on special subjects and conferences of representatives of interested agencies and organizations have prepared recommendations concerning the inquiries, after which the schedules have been revised and submitted to the Central Statistical Board for final clearance with other governmental agencies. The recommendations of the Board and of the special advisory committees were reviewed by the general Census Advisory Committee, which prepared final recommendations to the Director of the Census.

FIELD WORK

Necessary preparations for field work have included estimates of the number of persons to be employed in each supervisor's district, fixing of rates of pay for enumeration, preparation of card indexes of

new manfacturing and business establishments, and the writing of instructions for area and district supervisors and for enumerators.

RESEARCH

The Bureau has long been cognizant of several fundamental problems that present serious operating difficulties. The research staff has devoted a considerable portion of its time to discovering ways and means of gradually overcoming these obstacles. Many changes made in procedure have been adopted as a result of these studies.

One problem of the Bureau has resulted from the periodic expansion of the work load for each census. Only a small nucleus of trained personnel can be retained during the intercensal period to provide continuity and to carry on current statistical work. Temporary employees, most of whom are totally unfamiliar with census procedure and techniques must be selected and trained to do the work of the census. Scientific testing techniques for the selection of enumerators are being developed, and experimental methods for training clerks, editors, enumerators, and field supervisors for the coming census are being studied. The latest advances in visual education and other practical training procedures have been under investigation.

Each census finds increasing demands for information, both for an increased number of questions on the schedule and for additional cross tabulations. However, the costs of enumeration and the patience of the average housewife or businessman place a practical limit on the size which the schedules can attain. At the same time, even with the latest developments in tabulation techniques, it has been possible to make only a portion of the many tabulations of the data that are in demand. The solution of these problems as well as that of shortening the time between collection and publication of data have become of increasing importance to the Bureau. The need for a new method of attack has become apparent. The sampling method, already highly developed by statisticians and successfully used by governmental agencies and business organizations, has offered a method of solution.

The research staff has devoted a considerable portion of its time during the past year to a study of various phases of the sampling technique which might be applicable to the work of the Bureau. Considerable research has been performed and is now in progress on the relative efficiency of alternative methods of sampling, on the types of census questions which may be sampled most successfully, and on the size of sample required to obtain any specified degree of precision. The investigations have shown that statistics which are required in great detail for small areas are not adaptable to sampling, but that many items which are not required for local areas, or in great detail except on a major regional or national basis, may be enumerated and tabulated from a sample at low cost and with adequate precision. They have demonstrated that important information never before available because of enumeration or tabulation costs may be obtained by sampling.

BIENNIAL CENSUS OF MANUFACTURES, 1937

The 1937 Census of Manufactures was practically completed during the past fiscal year. Preliminary reports showing general statistics were published for separate industries during 1938, the first in June and the last in December of that year. A summary for the United States showing the same statistics by industries was issued on December 30. Preliminary reports showing production statistics were prepared and issued before the close of the fiscal year. Final industry reports also were prepared and these will be issued in 58 pamphlets, covering 351 industries.

The first 1937 State report was issued in February 1939 and the last in April 1939. Summary statistics were prepared for all cities having 10,000 inhabitants or more and for counties, and reports giving general statistics by industries were prepared for cities having 25,000 inhabitants and over where such statistics could be shown without disclosing the operations of individual establishments. Reports by industries were prepared for the 33 industrial areas, and a summary showing general statistics for all industrial areas was issued in April 1939. This is the first census since that covering the year 1904 in which general manufactures statistics by industries for all cities of 25,000 population or more have been compiled and published. In that year statistics for industries were shown for cities having 20,000 population or more.

Data on inventories in the hands of manufacturers at the beginning and end of 1937 were issued in April 1939, the first time that information of this nature has been secured at a Census of Manufactures. Data on the consumption of fuel and purchased electric energy were collected for 1937 and the statistics were presented in a report issued in June 1939. The last previous census for which detailed fuel statistics were published was that for 1929.

All manuscript for the final report, Census of Manufactures for 1937, which will consist of two volumes, was prepared and sent to the printer before the close of the fiscal year. Part I is primarily an assembly of the detailed reports for manufacturing and printing and publishing industries covered by the census; part II is an assembly of detailed reports for cities having 25,000 inhabitants or more and of inventories in the hands of manufacturers at the beginning and end of 1937, by industries and by States.

CURRENT STATISTICAL SERVICE

Due to a reallocation of work between the Bureau of the Census and the Bureau of Foreign and Domestic Commerce, effective February 28, 1939, several new current manufacturing and business inquiries have been added to those compiled by the Bureau of the Census. The reports added include: Monthly reports on sales from approximately 30,000 independent retail stores; monthly reports from approximately 3,300 wholesale firms, giving information on sales, accounts receivable, collections, and inventories (with a special form of inquiry in the drug trade); monthly reports from approximately 2,000 manufacturing establishments, giving information on sales,

accounts receivable, and collections (with a special form of inquiry in the drug trade); monthly reports on confectionery poundage from approximately 150 manufacturers, showing pounds sold during each period; and quarterly reports on canned food stocks. The reports on canned vegetable stocks in canners' hands are obtained directly from the National Canners Association which collects the figures from the entire industry; stocks of canned fruits are reported by some 60 packers; and both canned vegetable and fruit stocks are reported by approximately 500 wholesalers.

Improvements during the past fiscal year have been made in a number of the current statistical reports issued by the Bureau. Notable among these were the changes in the schedules on Railroad Locomotives and Mining and Industrial Locomotives which were revised to promote comparability between the two series, and extensions in coverage of the retail and wholesale reports.

A new record for timeliness was set with the 1938 report on the Manufacture and Sale of Farm Equipment and Related Products. A preliminary report on Tractors, Combines, and Grain Threshers was issued on January 25, 1939, and for all products on April 18, 1939.

QUINQUENNIAL CENSUS OF ELECTRICAL INDUSTRIES

Preliminary reports on the Census of Electrical Industries for the year 1937 had all been issued before the close of the past fiscal year, 12 being prepared for the electric light and power industry; 4 for street railways, motorbus, and trolley-bus operations; and 7 for telephones and telegraphs. In the electric light and power report a break-down by type of ownership is shown for the first time for the following groups: Privately owned electric utilities; municipally owned electric utilities; cooperatives, power districts, etc.; Federal- and State-owned utilities; and other groups. Data were also collected for the first time on radiotelephones and radiotelegraphs, and also on trolley busses as a separate industry.

CENSUS SURVEY OF BUSINESS

The 1937–38 Census Survey of Business, which was undertaken in February of 1938 with funds made available by the Works Progress Administration, was completed during the first week of February 1939. Reports were collected by means of a mail canvass from a large sample of independent and chain retail and wholesale stores, using as a basis for the mailing list reports received in connection with the 1935 Census of Business, eliminating retail establishments which reported sales of less than $5,000 for that year and wholesale establishments which reported sales of less than $25,000 for that year. Certain classifications which were either covered by other statistical series or could not be canvassed satisfactorily by mail were also eliminated. Usable schedules were received for approximately 133,000 retail stores and 18,500 wholesale establishments. The final reports for both retail and wholesale trade were published and distributed during the latter part of January and the first week of February 1939. The published material presented trend data on net sales, credit sales, pay rolls, and stocks for identical retail stores, and wholesale establishments for 1935, 1937, and the first half of 1938, correlated with the complete census data for 1935.

Special intracity tabulations of the 1935 retail trade data were made for the cities of Chicago and Buffalo. The final reports presenting these data by geographic areas and communities were issued for Buffalo in March 1939 and for Chicago in June 1939.

COTTON AND OIL REPORTS

An addition to statistics on cotton was made during the past season by collecting and releasing data showing quantities of cotton grown each year by counties. The additional inquiry required that each ginnery show the cotton ginned by the county of growth.

Regular reports were received from approximately 14,000 cotton ginneries, 500 cottonseed oil mills, 300 refineries and consumers of cottonseed oil, 3,000 storage places such as warehouses and compressors, and 2,000 cotton-consuming establishments. Reports were issued semimonthly for cotton ginned and monthly for cotton consumed and held, cotton spindle activity, and cottonseed and its major products. A special report on the bales and pounds of the several kinds of linters and other cotton fiber produced by the oil mills was also issued.

Closely related to the cottonseed oil reports are those for other vegetable and animal fats and oils. Reports are received from about 4,000 factories producing and consuming these oils and from 100 storage establishments. In addition to quarterly reports of vegetable and animal fats and oils produced, consumed, and held, the annual bulletin on this subject shows factory production, factory consumption, factory and warehouse stocks, imports and exports, and material used in the production of vegetable oils.

STATE AND LOCAL GOVERNMENT

Advisory committee.—A special advisory committee on statistics of State and local government consists of the following members:

CHARLES J. FOX, city auditor, Boston, Mass., chairman.
FREDERICK L. BIRD, director of Municipal Research, Dun & Bradstreet, Inc., New York City.
DAN O. HOYE, city controller, Los Angeles, Calif.
WELLES A. GRAY, finance department, Chamber of Commerce of the United States, Washington, D. C.
CARL H. CHATTERS, executive director, Municipal Finance Officers' Association, Chicago, Ill.
L. MCCARTHY DOWNS, auditor of Public Accounts, Commonwealth of Virginia, Richmond, Va.
WALTER R. DARBY, commissioner of Local Government, State of New Jersey, Trenton, N. J.

Two meetings were held in Washington during the year. Recommendations were made which were referred to the Director and the general Census Advisory Committee.

Statistics of States.—Collection of statistics of States was resumed during the past year with the collection of data relating to the year 1937. Statistics of States were collected annually from 1915 through 1919, and from 1921 through 1932, but were discontinued since 1932 because of reduced appropriations. The 1932 data were never published except in preliminary form and are being reported with those for 1937.

Preliminary reports for 1937 for 46 States were issued. A revised classification of accounts for revenues, expenditures, debt, and public-service enterprises, with a new handbook of instructions and definitions, was adopted. Statistics on the number of State employees, by quarters, and total pay roll were gathered and compiled for the first time. Compilation in the field of the State reports for 1938 was started during the year.

Statistics of cities.—The annual report, presenting data for cities having a population of 100,000 or more, was published in preliminary form for 1937 for 47 of the 94 cities. The report for all cities was not completed because of the additional work entailed by the restoration of the report on States, the separation of data on public-service enterprise, and the adoption of a revised classification of accounts for revenues, expenditures, and debt. The revised classification was adopted after conference with the National Committee on Municipal Accounting. Data on the number of employees, by quarters, and total pay roll for cities were gathered for the first time in 1937. Compilation in the field of the city reports for 1938 was started during the year.

Current special-subject studies.—Nonfinancial current studies were made on municipal employees in cities of over 100,000 population as of April 1, 1936; proposals voted upon in city elections, 1938; State proposals voted upon in 1938 general elections; and State tax laws in 1939 legislative sessions.

As part of a series of summaries on State finances, releases on special subjects were issued on the assessed value of property subject to general and selective property taxes by States, with comparative totals for 1932, and on State revenues from general and selective property taxes for 1937 and selected prior years.

Digest of State tax laws.—A Digest of State Laws Relating to Inheritance and Estate Taxes, 1938, and a Digest of State Laws Relating to Net Income Taxes, 1938, were compiled for publication.

Debt of State and local governments, 1937.—An intercensal report on State and local debt, an inquiry made in cooperation with the United States Treasury, was published by the Treasury under the title Securities Exempt From the Federal Income Tax as of June 30, 1937.

Municipal reference service.—Documentary material relating to local government organization, administration, and public reports was compiled in duplicate for 12 additional cities making a total coverage of 185 cities of over 50,000 population. The material was kept current and the scope of the service expanded.

New series of reports.—Plans were formulated and approved for the assumption of quarterly reports on local government employment and pay rolls and for preliminary reports of State tax collections.

VITAL STATISTICS

Advisory committee on vital statistics.—The advisory committee on vital statistics held one meeting in Washington during the past year. The committee has rendered valuable service in making

recommendations to the Bureau on the major vital statistics problems. The membership of the committee is as follows:

LOWELL J. REED, Johns Hopkins University, School of Hygiene and Public Health, Baltimore, Md., chairman.
HAVEN EMERSON, College of Physicians and Surgeons, Columbia University, New York City.
LOUIS I. DUBLIN, Metropolitan Life Insurance Co., New York City.
ROBERT E. CHADDOCK, Columbia University, New York City.
ROBERT OLESEN, Assistant Surgeon General, United States Public Health Service, Washington, D. C.
W. A. DAVIS, State registrar of vital statistics, Austin, Tex.
J. V. DEPORTE, director, division of vital statistics, State Department of Health, Albany, N. Y.
A. J. CHESLEY, secretary and executive officer, State department of health, St. Paul, Minn.
ISADORE FALK, chief, health studies, Bureau of Research and Statistics, Social Security Board, Washington, D. C.

Revision of the International List of Causes of Death.—The revision of the International List of Causes of Death has been a major activity throughout the past year. The chief statistician for vital statistics served as chairman of the American delegation to the International Conference for the Revision of the International List of Causes of Death, held in Paris in October 1938. A number of revisions in the International List were effected, some of which were drastic in character, particularly those involved with the maternal and cardiac causes of death.

A resolution was passed urging that the United States Government extend its work in connection with obtaining international consistency in the tabulation and interpretation of causes of death. The United States Government was requested to form a subcommittee comprising representatives of countries and agencies cooperating in the various lines of research concerning this subject. This resolution affords an opportunity for the Bureau of the Census to develop an international cooperative research plan for the solution of problems relating to the comparability of mortality statistics.

Uniform vital statistics bill.—A uniform State vital statistics bill was drafted in the spring of 1938. Clearance of interested governmental agencies was obtained by a series of weekly conferences, and a tentative draft was submitted to the State registrars at the fall meeting of the American Public Health Association. Among the agencies which have cooperated most closely in developing the draft were the Social Security Board, the Public Health Service, the Children's Bureau, the American Medical Association, the American Bar Association, the American Association of State and Provincial Registration Executives, and the State and Territorial Health Officers.

The new bill is based upon a broader legal theory than the first model law. The new features, in brief, are: It is drafted with the expectation that it will be adopted by the States without major changes in form or content; it gives only the more general principles of procedural and administrative law to be followed, leaving details to rules and regulations proposed by the State authorities in charge of public health; new items incorporated include marriage and divorce registration, a standard definition for stillbirth, and special provisions regarding delayed registration and the alter-

ing or amending of records already on file in the offices of State registrars.

New standard birth, death, and stillbirth certificates.—The decennial revision of the certificates of birth, death, and stillbirths was concluded during the past year. The principal changes made in the certificates were as follows: An improved statement for residence as distinct from place of death or place of birth; a revision of the medical certification on the death certificate, making it more consistent with practices of the other English-speaking nations; and the introduction on the death certificate of two items needed by the Social Security Board, that is, the Social Security account number and the age of husband or wife.

As a result of widespread clearance the new standard certificates represent a reasonable compromise to all interested groups. Forty States have already indicated that they will adopt the forms prior to January 1940.

The inclusion of the Social Security account number on the new death certificate makes possible the union of the occupational and income information on the records of the Social Security Board, with the mortality information on the death transcript coming to the Bureau of the Census. The Social Security Board has developed a proof of death form which they plan to have the local registrar fill out and mail to the Board. A carbon copy of the form will go to the State health office, from which the account number will be entered on the death transcripts which are sent to the Bureau.

Deaths in hospitals and institutions.—The principal new statistical project brought to completion in the current year was the tabulation of deaths by type of institution or hospital in which the death occurred. These deaths were further classified according to residence, to the size of the place of death, and to disease condition causing the death.

Field activities.—A number of vital statistics field projects have been conducted throughout the past year. The most important of these was a birth registration campaign in West Virginia, representing an experiment in a new type of program directed at promotion of birth registration. The experiment had as its goal the discovery of a technique for promoting completeness of birth registration by enlisting the aid of organizations in the local community. Over five hundred committees were organized in the various counties, led by people in the communities who were supplied with appropriate campaign information. As a result of the campaign more than fifty thousand persons mailed in cards to the State Health office requesting that the files be searched to determine whether their births had been registered.

Five regional conferences of State registrars were held in the spring of 1939. The regions covered the entire country and were identical with those used by the United States Public Health Service. Most of these meetings were attended not only by State registrars but by State health officers and the regional director of the United States Public Health Service. The regional groups were small, making it possible to have discussions on all of the questions which face the State registrars in the conduct of their programs. These conferences represent one of the most important phases in the development of vital statistics.

A redraft of the Physicians' Pocket Reference Manual marks the beginning of a campaign for educating physicians and medical students in vital statistics. This manual in the past has included only a statement of the main headings of the International List of Causes of Death. The revision contains a description of the procedure and duties of the physician in filing certificates and information on the value of registration, as well as an indexed copy of the new International List of Causes of Death. Useful tables of the statistics needed by the physician are included; also a selected bibliography so that he can inform himself concerning vital statistics if he wishes. The physicians' handbook represents the inception of an educational campaign directed at medical students in their graduating year. It is hoped that the facts in it can be introduced into lectures for medical students and incorporated into the essential knowledge required for graduation.

POPULATION

Estimates of population.—Estimates of the population of the continental United States and of the outlying territories and possessions, as of January 1, 1938, and as of July 1, 1938, were issued by the Bureau. No estimates of the population of individual States were made for 1938 because of the lack of satisfactory data on interstate migration, and no further estimates for the United States will be made until after the 1940 census.

Special population censuses.—Special censuses, under the supervision of representatives of this Bureau, were taken during the year for the following places:

Markham, Cook County, Ill., as of November 14, 1938.
Riverside, Cook County, Ill., as of December 14, 1938.
Lincolnwood, Cook County, Ill., as of December 28, 1938.

Official certificates of population.—Eleven official certificates of population, under seal of the Department of Commerce, mainly for use in cases coming before the courts, were issued during the year.

Special studies.—Considerable work was involved in the preparation and analysis of data on the population of Canadian origin in the United States. This material is to form part of a report which is being prepared as a joint project with the Dominion Bureau of Statistics.

A special report giving "Comparative Occupation Statistics, 1870 to 1930," has been prepared and will be forwarded for printing at an early date. The statistics presented in this report reflect the industrial progress of the Nation through 60 years of its history.

A Topical Index of Population Census Tabulations, 1930, was practically completed at the close of the year. This index will enable persons interested in population statistics to determine the unpublished 1930 data available in the Census Bureau.

Institutional population.—The annual reports on Patients in Hospitals for Mental Disease and on Mental Defectives and Epileptics in Institutions, 1937, were forwarded for printing in June. The delay in the receipt of schedules for a relatively small number of institutions greatly retarded the compilation of the statistics for these classes of the population. In general, however, the cooperation of the institutions in this work has been highly satisfactory.

STATISTICS OF CRIME

The report on Prisoners in State and Federal Prisons and Reformatories for 1937 was nearly completed for publication during the past year.

The form of the annual report on Judicial Criminal Statistics was changed for 1937, thus enabling the Bureau to secure an early release for these statistics. The report consisted of 29 State summaries, together with an introductory text.

POPULATION INDEXES

Since the enactment of the social security legislation, the number of requests for certification of age received in this Bureau has greatly exceeded the number expected. The Social Security Act alone is not responsible for the great influx of applications. Requests are received regularly from the Civil Service Commission, the Veterans Administration, and other governmental agencies, as well as from individuals seeking certification of their ages as an aid in securing employment, passports, insurance, and for other purposes.

To locate an individual in the large bound volumes, which consist of the original census schedules made out by enumerators in their house-to-house canvass, it is necessary to have the exact place of residence at one of the census periods. Then the enumerator's district must be ascertained before a search of the records is begun. This procedure involves, of course, much time and labor. The index, on the other hand, makes it necessary to know only the State in which the person resided and the name of the head of the household.

The index for the 1900 census, the only census for which a complete index has been made, has proved so efficient that a similar index of the persons enumerated at the census of 1920 is being compiled in New York City with funds allotted by the Works Progress Administration. On June 30, approximately 2,200 persons were employed on this project, transcribing, verifying, and indexing approximately 58,000,000 cards. Through June, the States of Ohio, Pennsylvania, Massachusetts, Illinois, New York, and California had been completed, and 29,092,639 cards had been finally verified. This index will contain 105,000,000 names and, when completed, will be the largest of its kind in the world.

To reduce the space required for its retention in the Bureau, the index of 1900 has been reproduced on 16-mm. film. For the purpose of preserving records of the original population volumes, all of them for the years 1840 through 1870 as well as 518 volumes of the Census of 1880, making a total of 3,137 volumes, have been placed on 35-mm. film. The census records through the year 1830 have been photostated.

SEARCHING OF POPULATION RECORDS

The increased demand for age data, as contained in the census records, is evidenced by the fact that 163,132 requests for this information were received during the past fiscal year, as compared with 4,166 a decade ago. In addition, 5,836 visitors called to examine the population records prior to the census of 1880 which have been

made available for genealogical searches. The personal data recorded for the census of 1880 and subsequent censuses are strictly confidential and will be furnished only to the person enumerated, to a member of his immediate family, or to his legally authorized representative, upon written request. A total of 123,133 requests were answered during the year. On June 30, there were on hand 85,947 applications to be answered.

PHOTOSTAT AND MICROFILM LABORATORY

In addition to microfilming the population volumes, the Bureau has furnished numerous universities and historical societies with microfilm or photostatic copies of many of the earlier census records. The Bureau has also been able to furnish microfilm and photostat services at cost to a number of other governmental agencies. During the fiscal year, a total of more than 90,000 photostatic prints were made.

CENSUS OF RELIGIOUS BODIES

The Decennial Census of Religious Bodies, 1936, taken in accordance with the provisions of the permanent Census Act passed in 1902, is nearing completion. The field work on this survey was terminated at the close of December 1938. A total of 259 denominations have furnished reports covering 200,938 churches. Through June, 60,358 schedules have been edited and sent forward for tabulation, and the first bulletins will soon be ready for printing. These bulletins will contain, in addition to membership, financial, and other data, a summary of the history, doctrine, organization, and work of each denomination.

FOREIGN STATISTICS

The collection, classification, and indexing of foreign statistical material has been continued. The exchange of official statistical publications with countries that issue such publications is being carried on in accordance with arrangements made early in 1939. A large number of requests for foreign statistical material were received and complied with.

MACHINE TABULATION

The tabulation equipment available in the Bureau of the Census constitutes a valuable source of service, not only to the various divisions of the Bureau, but also to other governmental agencies and nongovernmental organizations. The extent of this service may be measured, in part, by the fact that during the past fiscal year a gross total equivalent of 177,336,717 punched cards were handled.

Over 78 percent of the tabulations were required for the usual work of the Bureau of the Census. The Biennial Census of Manufactures accounted for 12 percent of the cards handled. Other subjects for which work was done included administration, agriculture, business, cotton and oils, religious statistics, population, and vital statistics. About 18 percent of the cards handled were involved in assignments for other governmental agencies, while the remaining 4 percent represented work done for nongovernmental organizations on a cost basis.

Activities in machine tabulation included testing of equipment in preparation for the forthcoming decennial census, although this program was limited by the press of current work.

PUBLICATIONS

Biennial Census of Manufactures, 1937.—Results of the Biennial Census of Manufactures, 1937, were made public during the fiscal year through preliminary industry reports and State reports. Twenty-seven final industry reports have been printed, and the following releases have been issued:

Inventories in the hands of manufacturers at the beginning and end of 1937.
Cost of materials, containers, fuel, purchased electric energy, and contract work, 1937.
Consumption of fuel and purchased electric energy, 1937.
Wage earners, by months, 1937.
Personnel other than wage earners, and salaries paid, 1937.
Wage earners and wages in establishments classified according to number of wage earners, by industry groups, industries, and geographic divisions and States, 1937.
Relative importance of leading industries, for the United States, 1937.

ANNUAL REPORTS

Statistical Abstract of the United States.—The 1938 edition of the Statistical Abstract, a volume of 882 pages, was completed and published during the year and preparations for the 1939 edition were well under way at the close of this period.

The Statistical Abstract is a compilation of authoritative figures derived from reports of the Bureau of the Census and other agencies, Federal, State, and nongovernmental, relating to the social and economic condition of the population and to the industrial, commercial, and governmental activities of the Nation. The Abstract has a wide distribution among businessmen, economists, statisticians, students, and others who have need for a convenient reference work of this character.

Other annual reports.—
Judicial criminal statistics, 1937.
Patients in hospitals for mental diseases, 1936.
Mental defectives and epileptics in institutions, 1936.
Mortality statistics, 1936.
Birth, stillbirth, and infant mortality statistics, 1936.
Manufacture and sale of farm equipment and related products, 1938.
Lumber cut in 897 identical mills, 1938.
Cotton production and distribution, season of 1937–38.
Cotton production—crop of 1938.
Animal and vegetable fats and oils, 1934 to 1938.

SPECIAL REPORTS AND RELEASES

The Bureau issues regularly a large number of preliminary releases of data which are later included in reports. Many of these releases are not specificially mentioned in the following list, which includes special reports and releases of general interest.

Agriculture, industry, trade, and finance.—
Geographic distribution of retail trade in Buffalo, N. Y, 1935.
Geographic distribution of retail trade in Chicago, Ill., 1935.
Census survey of business, 1937–38, retail survey.

Census survey of business, 1937–38, wholesale survey.
A digest of State laws relating to inheritance and estate taxes, 1938.
Proposals voted upon in city elections, 1938.
State proposals voted upon in the 1938 general elections.
Chickens and eggs by size of flock.

Vital statistics and population.—
Age composition of the Nation's labor force, 1890–1930.
Industrial distribution of the Nation's labor force, 1870–1930.
Estimates of population (2 releases).
Judicial criminal statistics in 43 Ohio counties, 1937.
Weekly health index.
Weekly accident bulletin.
Monthly vital statistics bulletin.
Negro newspapers and periodicals in the United States, 1938.
Convention dates of Negro organizations, 1939.

CURRENT REPORTS

Cotton and oils.—
Cotton ginnings (12 reports).
Cotton consumed and stocks held (monthly).
Cottonseed and cottonseed products (monthly).
Animal and vegetable fats and oils (quarterly).

Current business reports.—
Retail sales, independent stores (35 monthly reports consisting of a summary and separate reports for 28 States and 6 cities).
Wholesalers' sales, stocks, collections, and accounts receivable (monthly).
Canned foods stock (quarterly).

CURRENT INDUSTRIAL REPORTS

(A) MONTHLY REPORTS

Air-conditioning systems and equipment
Automobiles
Automobile financing
Bathroom accessories
Boots, shoes, and slippers (other than rubber)
Cellulose plastic products
Commercial steel castings
Confectionery and competitive chocolate products
Convection-type radiators
Cotton, leather, and allied garments
Distillate oil burners
Domestic pumps and water systems and windmills
Domestic water-softening apparatus
Electric industrial trucks and tractors
Fabricated steel plate
Fire-extinguishing equipment
Floor and wall tile
Galvanized range boilers and tanks for hot-water heaters
Hosiery
Imported dates
Knit fabric gloves
Knit wool gloves and mittens
Leather gloves and mittens
Malleable iron castings
Manufacturers' sales and collections on accounts receivable
Measuring and dispensing pumps (gasoline, oil, etc.)
Mechanical stokers
Men's, youths', and boys' clothing cut
Methanol
Oil burners
Paint, varnish, lacquer, and fillers
Paperboard
Plastic paints, cold-water paints, and calcimines
Plumbing brass
Porcelain enameled products
Prepared roofing
Public merchandise warehousing
Pulverizers
Pyroxylin-coated textiles
Railroad locomotives
Red-cedar shingles
Steel barrels and drums
Steel boilers
Steel office furniture, shelving, and lockers, and fire-resistive safe industry products
Structural-clay products
Sulphuric acid
Superphosphates
Terra cotta
Underwear and allied products
White-base antifriction bearing metals
Wheat-ground and wheat-milling products by States and capacity groups
Wool consumption
Wool machinery activity

(B) QUARTERLY REPORTS

Edible gelatin
Electric (mining and industrial) locomotives
Electrical goods
Lacquers
Wheat and wheat-flour stocks
Wheat-ground and wheat-milling products (merchant and other mills)
Wool stocks

WORK DONE FOR OTHER FEDERAL OFFICES AND OUTSIDE ORGANIZATIONS

The Bureau is frequently called upon to provide statistical material from its stores of unpublished information relating to censuses and surveys already taken. Much of this service is in the form of correspondence and special requests which can be answered with a relatively small expenditure of time. Where more extensive investigations or tabulations are involved, the service is performed on a reimbursement basis. The Bureau provides, in addition, mechanical tabulation service, on a cost basis, which is utilized by other governmental and outside organizations

The Federal agencies provided special statistical or tabulation service on a reimbursement basis during the past year included: Works Progress Administration, Rural Electrification Administration, Civilian Conservation Corps, Federal Power Commission, Bureau of Marine Inspection and Navigation, Bureau of Fisheries, Bureau of Foreign and Domestic Commerce, and the Temporary National Economic Committee.

PERSONNEL

Training courses for employees.—There were approximately 100 employees who registered in the in-service training program of the Bureau during the past year. This training program has been maintained in the Bureau since 1935, and through special arrangements with one of the local universities the employees enrolled in these courses may obtain academic credit for their work. Classes were conducted in accounting, statistical cartography, economic geography, elementary statistics, and research methods in statistics. All of the courses were taught by technical members of the Bureau's staff.

Student-intern program.—Eleven graduate students participated in the student-intern program in the Bureau during the past year. The purpose of this program was to give training in public administration to students especially interested in this subject. It was felt that these associations were of mutual benefit to the students and to the Bureau. This intern group was given special guidance by the Bureau's technical staff.

Appointments and separations.—The following table shows the number of employees on the regular roll of the Bureau for the past fiscal year. In addition to these regular employees, however, there were a number of special agents appointed for limited periods. On June 30, 1939, there were on the roll 3,727 of these temporary special agents of whom 610 were employed in the Washington office and 3,117 outside Washington. Of those employed in the Washington office 457 were engaged on Works Progress Administration projects. In the other group 25 were employed on a project in Philadelphia

and 2,292 on a project in New York City. For the fiscal year there was a total of 13,795 special agents appointed while the separations numbered 14,562.

	Bureau total	Washington office	Field
Total employees on roll, June 30, 1939	1,728	903	825
Permanent	1,589	801	[1] 788
Temporary	139	102	37
Total appointments, fiscal year	547	427	120
Permanent	206	131	75
Temporary	341	296	45
Total separations, fiscal year	1,015	599	416
Terminations	262	116	146
Expirations of appointments	565	389	176
Transferals	45	45	
Resignations	122	31	91
Retirements	11	11	
Deaths	10	7	3

[1] Includes special agents for cotton and for vital statistics.

APPROPRIATIONS

A total of $45,100,000 was authorized for the work of taking, compiling, and publishing the Sixteenth Census of the United States. The sum of $21,900,000 was appropriated under an act approved June 29, 1939, for the fiscal year ending June 30, 1940, and of this sum $50,000 became available immediately. For salaries and necessary expenses for searching census records and supplying information incident to carrying out the provisions of the Social Security Act, there was appropriated, also, by the act of June 29, 1939, the sum of $100,000 for the fiscal year mentioned.

An additional $8,000,000 was authorized for the Census of Housing to be taken in conjunction with the Sixteenth Decennial Census but no funds were appropriated. The Bureau will request a supplemental appropriation in the first deficiency bill of the forthcoming session of Congress.

Appropriations and other funds made available to the Bureau of the Census, by source, fiscal year ended June 30, 1939

Purpose	Total	Source of funds		
		Bureau appropriations	Allotted or transferred from other Federal agencies	Non-governmental
All Bureau work	$2,180,554	$2,090,000	$85,342	$5,212
Regular salaries and expenses	2,090,000	2,090,000		
Work relief project: Census of Business	9,200		9,200	
Work for other Federal agencies:				
Unemployment Census	10,000		10,000	
Other	66,142		66,142	
Work for outside organizations or individuals	5,212			5,212

NATIONAL BUREAU OF STANDARDS

GENERAL ACTIVITIES

Finances and personnel.—The Bureau's appropriation for 1939 was $2,615,000. This included $500,000 for construction and equipment of the new high-voltage laboratory and $198,000 for the special investigation of building materials and structures with particular reference to low-cost housing. The sum of $24,000 for travel was allotted from the consolidated funds of the Department of Commerce.

The regular staff at the close of the year (including temporary employees) numbered 950, an increase of 21 as compared with the preceding year. In addition, 80 research associates, supported by national engineering societies and trade associations, were engaged on technical problems of mutual interest to the Government and industry. Last year 59 associates were stationed at the Bureau. The increase is significant as illustrating the growing appreciation of research by American manufacturers.

Testing.—The Bureau has continued to act as the principal testing laboratory for supplies purchased by the Government and, in addition, has done a large amount of testing for the general public in fields not covered by private laboratories. This is a fundamental service which occupies the entire time of about one-half of the Bureau's staff.

Publications.—The results of the year's work have been made available through 288 publications and articles. In addition, 30 mimeographed letter circulars and notes on subjects concerning which many inquiries are received were prepared and distributed on request.

Visiting committee.—The members of this committee are: Morris E. Leeds, president of the Leeds & Northrup Co.; Dr. William D. Coolidge, director of the research laboratories of the General Electric Co.; Dr. Frank B. Jewett, president of the Bell Telephone Laboratories; Dr. Karl T. Compton, president of the Massachusetts Institute of Technology; and Gano Dunn, chairman of the J. G. White Engineering Corporation. The committee has furnished valuable advice on mapping out the Bureau's work, particularly in the field of research.

International comparisons of electrical and photometric units.—In pursuance of the program for establishment of new values for the units of electricity and light, the Bureau sent groups of standard cells and standard resistors to the International Bureau of Weights and Measures and standard lamps to the National Physical Laboratory of Great Britain, for comparison with similar standards from other countries. These standards have now been returned, and remeasurement at the Bureau shows that they remained very stable in value.

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Such measurements give a very precise comparison with units now maintained in other countries and also provide a basis for combining the results obtained in various laboratories which are engaged in determining the values of the units by absolute measurements. The Bureau has reported the results of its determinations, but the international program has fallen behind schedule, particularly because no definitive reports on electrical units have been received from the German national laboratory.

The three national laboratories taking part in the comparison of lamps are in good agreement as regards average values, but further measurements are necessary to explain variations of results on individual lamps. Comparisons of standards for flux of light (lumens) must also be made, and this must be extended to include lamps of the gas-filled tungsten type before the new units can be put into practical use.

Because of the delays in the international program, it is evident that new values of the units cannot be introduced into use as of January 1, 1940, as was planned. In June, meetings of international committees dealing with the two classes of standards were held in Paris, and the International Commission on Illumination (which is concerned with the units of light) met in Holland. At these meetings the Bureau was represented by E. C. Crittenden, assistant director. It was decided to introduce the new photometric units on January 1, 1941. The date for actual introduction of the new electrical units remains uncertain.

Twenty-ninth National Conference on Weights and Measures.—Official delegates from 27 States and the District of Columbia attended this conference, held at the Bureau on June 6 to 9, inclusive. In addition to the weights and measures officers of States, cities, and counties, representatives of manufacturers of weighing and measuring equipment and of industrial, business, and consumer groups were also present. Of special interest and importance was the consideration of the quantity standardization of packaged food commodities, in which container manufacturers and food distributors participated; a report by a special conference committee, recommending such standardization, was adopted, and the committee was instructed to carry on further studies and to formulate plans for putting its recommendation into effect. Papers were presented on a variety of subjects including the new Federal Food, Drug, and Cosmetic Act, retail sales by weight and by measure, tolerances, coordination of activity with respect to interstate shipments, and test weights of large denominations. Some additions to and changes in the specifications and tolerances for commercial weighing and measuring devices were adopted, and a report was presented summarizing the results of the vehicle-scale testing program being carried on by the Bureau in cooperation with the States.

Conference of public-utility engineers.—Forty-two commision engineers from 26 States, the District of Columbia, and Canada met with representatives of the Federal Government concerned with the technical aspects of public-utilities regulation in their seventeenth annual conference on May 16 to 18. Meetings were held at the Bureau, and 11 formal papers were presented and discussed. The conference was the most widely representative of any thus far held on this subject.

American Standards Association.—The Bureau takes an active part in the work of this association. In addition to representation on over 100 sectional committees dealing with technical projects and the primary responsibility for 25 of them, it is represented on the following coordinating agencies of the association: The Board of Directors, the Standards Council, the Safety Code Correlating Committee, the Electrical Standards Committee, the Mechanical Standards Committee, the Advisory Committee on Ultimate Consumer Goods, and the Building Code Correlating Committee. The Bureau's safety-code work is conducted under the procedure of, and all of its safety codes have been approved by, the association. All of the building-code and plumbing-code requirements thus far formulated under the auspices of the Bureau have been accepted as a basis for the development of building and plumbing codes under the American Standards Association procedure. Two members of the staff of the association are located at the Bureau to facilitate the cooperative work of the two organizations.

Federal specifications.—The Bureau makes many investigations and tests in connection with the development and use of purchase specifications by the Federal Government. The Director serves as chairman of the Federal Specifications Executive Committee, under the auspices of which 1,238 specifications have been prepared for the use of executive departments and establishments of the Government.

ELECTRICITY

Fundamental electrical measurements.—In accordance with decisions of the International Committee on Weights and Measures, new values of the electrical units based upon "absolute" measurements were to be used beginning January 1, 1940. In preparation for this anticipated change, the Bureau carried through two entirely independent determinations of the absolute ohm and a determination of the absolute ampere. One method of measuring the absolute ohm made use of a self-inductor, while the other method utilized a mutual inductor of a new design. Results obtained from the self-inductor method were published in 1936. More reliable results have been obtained during the past year owing to the construction of an improved self-inductor, consisting of a coil of wire wound on a large threaded Pyrex glass cylinder. The results obtained from this new self-inductor may be expressed as follows:

$$1 \text{ NBS ohm} = 1.000\ 48 \text{ absolute ohm.}$$

The mutual-inductor method has been carried to completion for the first time, and the result agrees with those for the self-inductor method within a few parts in a million.

Results of absolute ampere measurements have also been obtained previously, but these measurements have been repeated after a number of important improvements in the equipment. The latest results of this work (RP1200)[1] give

$$1 \text{ NBS ampere} = 0.999\ 86 \text{ absolute ampere.}$$

[1] Elements in parentheses identify the serial number of the paper and the Bureau publication in which it appeared. RP refers to a paper in the Journal of Research of the National Bureau of Standards; BMS, Building Materials and Structures; R, Simplified Practice Recommendation; CS, Commercial Standard; H, Handbook.

Determinations of the ohm and the ampere are sufficient to fix the values of all the electrical units in absolute measure. To this end, the International Committee on Weights and Measures will consider the results of the Bureau's determinations along with those from other national standardizing laboratories.

Radio.—The regular broadcasting of standard radio and audio frequencies was continued, and the high reliability and accuracy of this service were further improved. Modulators of greater output were installed, and frequency multiplying and monitoring devices were made more positive and automatic. The primary standard of frequency was improved by the addition of oscillators of greater constancy.

Radio-wave transmission was studied by means of measurements of intensities from distant stations and observations of radio echoes from the ionosphere. This work supplied useful information on a number of practical problems such as selection of radio frequencies for transmission over specified distances at various times of day and year; determination of received intensities and limit of usable frequencies for various distances, times, and locations of transmission path; means of carrying on radio communication at times when radio conditions are irregular because of disturbances radiated from the sun or other causes. A service of monthly predictions of ionosphere and radio conditions was inaugurated. The results of the Bureau's radio-wave research were utilized by the Interdepartment Radio Advisory Committee in the assignment of frequencies to Government radio stations, and by the Government committees preparing for the next meeting of the International Radio Consulting Committee.

The radio sonde (also called radio meteorograph) developed by the Bureau was put into regular service by the Navy, by the Weather Bureau, and by other Government agencies, supplanting airplane flights as a means of securing data on upper-atmosphere pressure, temperature, and humidity. It was found useful over the oceans as well as over land. The Bureau cooperated in the service application of the system, carefully observed performance, and developed means for further improvements. An electrical hydrometer was devised for use in the radio sonde, which greatly increases the accuracy of humidity determination.

Physical photometer.—A physical photometer, consisting essentially of a sensitive thermopile and galvanometer and a filter specially designed to duplicate the color sensitivity of the eye, was used to measure the light from vacuum tungsten-filament lamps for which values had been determined visually at the Bureau and at the National Physical Laboratory of England by means of blue glass filters. The results with the physical photometer agree to within 0.05 percent with the values obtained visually.

Magnetic measurements.—A new permeameter for measurements at high magnetizing forces was developed. This instrument is particularly adapted to the testing of the new magnetic alloys which have greatly extended the use of permanent magnets in recent years. Measurements of high accuracy can be made at magnetizing forces up to 5,000 oersteds.

Soil-corrosion investigations.—Five papers (RP1171) and one book dealing with corrosion of pipe lines and other metal structures buried in the ground were published. Five additional papers, prepared for

technical societies, have been completed and will appear in the 1939 proceedings of the associations before which they were presented. Two improved half cells for the more accurate measurement of potentials in soils were developed. These instruments assist engineers in predicting the probable corrosion of a pipe in any given location, thus indicating whether special protective measures are necessary.

Standard of electromotive force.—Previous work having demonstrated that excellent standard cells can be made by the substitution of small amounts of deuterium oxide (heavy water) for part of the ordinary water, experiments to include higher percentages of deuterium oxide are being made. Data on solubility of cadmium sulfate in various concentrations and at various temperatures are being obtained before constructing new cells.

Storage-battery research.—No accurate method has been available for determining the solubility of lead sulfate in solutions of sulfuric acid—the fundamental reaction in the lead storage battery. Using an organic reagent, diphenylthiocarbazone, and a photronic cell as the detector, a new and precise method for studying this reaction has been developed.

New high-voltage laboratory.—Complete plans for the laboratory building were drawn up by the Procurement Division, Public Buildings Branch, in accordance with instructions from the Bureau's staff, so as to meet the various special requirements of the high-voltage and X-ray researches for which the building is to be used. The main construction contract was let to the Ross Engineering Co. and work is well under way. At the same time plans and specifications for the electrical equipment have been prepared and orders have been placed for much of it. The building is scheduled for completion in January 1940.

WEIGHTS AND MEASURES

Testing vehicle scales.—Vehicle-scale testing programs were completed in the States of Ohio, Kentucky, Indiana, Arkansas, Missouri, and Iowa, and in the cities of Detroit, Mich., and Chicago, Ill. This raises to 25 the number of States in which either complete or partial surveys have been made since the project was begun in 1936.

Five hundred eighty-one wagon and motortruck scales were examined, most of these being operated by individuals or firms engaged in retail business. The basic tolerance applied to vehicle scales is, in general, ± 0.20 percent of the test-weight load. Of the scales tested, 28.4 percent were found to be accurate, the remaining 71.6 percent developing one or more errors in excess of the tolerance.

The constructive results from this vehicle-scale testing project are indicated by the number of instances in which improved testing equipment has been procured by State agencies following the Bureau's demonstration of the need for better facilities.

Testing railway track scales.—Calibrations of 16 master track scales showed all to be within the maintenance tolerances, while 11 were within the adjustment tolerances. All scales were left weighing within the adjustment tolerances; maximum errors were less than 0.01 percent for all but 1 scale, this figure being only slightly exceeded in the exception noted.

A total of 1,165 commercial railway track scales were tested by the three Bureau equipments on the lines of 109 railroads in 35 States and in the District of Columbia. Of this total, 635 scales were owned by railroads and 530 are classified as industry-owned scales. Upon the basis of the tolerance of ±0.20 percent of the test load, 981 scales, or 84.2 percent, were found to be accurate; this represents a substantial increase in scales found accurate over the corresponding figure for the preceding year, 81.0 percent.

Tolerances for railway track scales.—The Bureau tolerances for railway track scales were modified to bring them into harmony with those adopted by the Association of American Railroads. The changes provide tolerances for automatic indicating and recording attachments and make somewhat more severe the general accuracy requirements. These new tolerances will be applied on and after July 1, 1939.

Tolerances for test weights of large denominations.—The Bureau tolerances for new test weights of class C in denominations of 50 pounds to 10,000 pounds, inclusive, were revised, being reduced in some instances for the smaller weights and somewhat increased for the larger ones, and a new series of maintenance tolerances was adopted.

Tests of weighing and measuring appliances.—There was a marked increase during the year in the number of tests of weights and measures items of direct interest to the ultimate user, such as glass volumetric apparatus used by chemists, dilution pipettes and counting chambers used by doctors in making blood counts, steel measuring tapes used by civil engineers, precision gage blocks, screw-thread gages and other limit gages used by industry in interchangeable manufacture, watches for the public, and for various branches of the Federal Government.

Identification.—The most important service which the Bureau rendered for the Government in this field was that for the State Department in its hearings on the Black Tom case before the German-American Mixed Claims Commission. Testimony of the Bureau's experts was instrumental in exposing fraud in the preparation and presentation of the case by the opposition. The final decision awarded damages of several million dollars to the United States Government's clients.

Dental research.—The cooperative research with the American Dental Association has made excellent progress. The manufacturers of dental restorative materials have given support to the work by improving numerous products until they now meet the high standards developed at the Bureau. A list of trade brands of dental materials that have been tested and found to meet these standards appears in the July 1939 issue of the Journal of the American Dental Association.

Cooperation with State conservation departments.—For several years the Bureau has conducted a cooperative standardization program to develop a satisfactory method of specifying and measuring the mesh size of gill nets used in taking fish commercially on the Great Lakes. This has been carried out under the direction of Dr. John Van Oosten, of the U. S. Bureau of Fisheries, at Ann Arbor, Mich. Detailed specifications and a method of test for gill-net gages were developed by the Bureau, a contract was negotiated with a manu-

facturer to furnish the gages, and during the past year more than 4,000 gill-net gages have been tested and forwarded to the various State conservation departments.

New Equipment.—A 60,000-pound vehicle scale with a 40- by 10-foot platform has been installed at the Bureau. A beam for the sealing of heavy weights from 100 pounds to 1,000 pounds and a 10,000-pound scale for testing weights of more than 1,000 pounds and for the weighing of heavy loads have also been procured. It is now possible to test weights up to 10,000 pounds and to weigh loads accurately up to 60,000 pounds. The Bureau has long needed such facilities.

HEAT AND POWER

Spectral emissivity of metals.—In order to predict the probable life of electrical heating elements, it is necesary to measure the temperature at which these elements operate. The Bureau has therefore determined emissivity values for all the alloys in common use. The work is being extended to include a considerable number of other metals.

Thermal properties of water and steam.—For a number of years the Bureau, in cooperation with other laboratories in the United States, England, Germany, and Czecho-Slovakia, has conducted a research on the properties of water and steam. The results are of international as well as national importance, because they form the basis of accurate tables of properties of steam which are used throughout the world in the design and the efficiency rating of central station steam plants for the production of electric power. The experimental program of the Bureau has recently been completed, and the results are being prepared for final publication. The satisfactory completion of this project provides a basis for international uniformity in tabulating the properties of water and steam.

Hydrogen isotopes.—Pure HD, an isotopic form of hydrogen, containing an atom of light and an atom of heavy hydrogen, was prepared by distillation at $-252°$ C for an investigation of its properties at the Bureau and elsewhere. This modification of hydrogen had not heretofore been prepared in a pure state. Using this material, the low temperature properties of HD were measured at the Bureau and at Columbia University.

Fire-resistance tests.—Fire tests were conducted of bulkhead constructions which form the main transverse fire barriers in ships and of bulkheads subdividing passenger spaces. These covered the full range in available materials. The fire and smoke hazard of deck coverings and heat-insulating materials was also determined. Performance standards were developed for flameproofed cotton duck based on fire tests before and after subjection to accelerated weathering.

Phenomena of combustion.—Simultaneous measurements of the flame travel and rise in pressure during explosions of carbon monoxide, benzine, n-heptane, and iso-octane mixed with oxygen or oxygen diluted with nitrogen, in a spherical bomb of constant volume, have been made for the National Advisory Committee for Aeronautics. The results indicate that the normal burning of these hydrocarbon fuels gives no clue as to their relative tendency to knock in an engine,

and that the reaction continues for a considerable distance behind the flame front.

Primary standards for knock testing.—A report was published on the properties of normal heptane and iso-octane, the primary standards for knock rating of fuels for internal-combustion engines (RP1160). The new fractionating columns have been used to obtain considerable amounts of both materials, better than 99.9 mol-percent pure. Work is in progress on the impurities in synthetic heptane.

Diesel-fuel rating.—The Bureau has cooperated with 20 other laboratories in trying out the proposed Cooperative Fuel Research method for rating the ignition characteristics of Diesel fuels, published in 1938 by the American Society for Testing Materials. Three fuel samples are rated and reported each month.

Investigation of paraffin hydrocarbons.—In cooperation with the National Advisory Committee for Aeronautics, the Bureau of Aeronautics of the Navy Department, and the Army Air Corps, the properties of branched-chain paraffin hydrocarbons within the boiling range of gasoline are being investigated to determine what compounds have promise as constituents of the optimum synthetic aviation fuel. A number of paraffins have been isolated from industrial synthetic crudes by means of high-efficiency fractionating columns, designed at the Bureau, which operate 24 hours a day with automatic control. Other paraffins have been synthesized by standard methods, and research on new methods is in progress. The hydrocarbons yet to be prepared are mainly nonanes and decanes.

Wear of metal surfaces.—A simple method has been developed for measuring metallic wear with a precision many times greater than previous methods. A diamond-shaped mark is made in the metallic surface and the change in the length of the mark is used as a measure of wear. By means of a simple microscope it is possible to measure wear with a precision of approximately one one-hundred-thousandth of an inch, and this measurement is free from effects of distortion which have been the main cause for inaccuracy in previous wear measurements.

Automotive oil filters.—In cooperation with the Procurement Division of the Treasury Department and the Quartermaster Corps of the Army, a method suitable for inclusion in Government purchase specifications has been developed for rating the efficiencies of oil filters for use on automotive equipment.

Low-tension cable.—The low-tension cable specifications (Navy 15–C–5) were revised in conjunction with the Navy Department and manufacturers to embrace insulating materials other than rubber and to provide for a thinner-walled higher heat-resisting insulating compound.

OPTICS

A new hardness tester.—Glass is in many cases an ideal material for accurate line scales, and diamonds furnish the most reliable ruling points. However, on investigating the endurance of a diamond point for ruling on glass it was found that, under a given ruling load, a line showed a constant width for a length of not more than 4 inches, the diamond thereafter exhibiting appreciable wear. This is important in connection with an application in which the width of a diamond-ruled line is used to indicate the "scratch-hardness" of

glasses, from which their relative resistance to abrasion is determined. On realizing the error involved in this method, the glass industry appealed to the Bureau to develop a reliable method for measuring the hardness of glasses.

The solution was found by constructing a minute pyramidal diamond indentation tool of accurate form which measures not only the hardness of glass but also that of many other materials that could not be tested satisfactorily by previous methods or with other existing shapes of indenters. The data likewise supply information on the elastic recovery of a material as well as its resistance to indentation. The most valuable extension of its use has been to measurements of plated metal, nitrided surfaces, thin sheet metal, individual particles and areas of high-speed steels, crystalline and molded abrasives. Its wide range of application is illustrated by the fact that it gives hardness values ranging from that of optical pitch 1–22 to diamond 8,000–8,500. In response to widespread demands of glass technologists, metallurgists, and others for a microindentation tester which incorporates this indenter, arrangements have been made for producing the instrument commercially (RP1220).

Revision of the Munson-Walker table for the determination of reducing sugars.—In 1906 Munson and Walker surveyed the methods then generally employed for the determination of reducing sugars (dextrose-levulose mixture) and proposed one which, because of its simplicity and reproducibility of results, has deservedly gained widespread use. There has been, however, no redetermination of their original values and no additions in 33 years. Recently, because of sugar quota restrictions, synthetic molasses has been produced in the Tropics and imported into the United States in large quantities. Because of the high invert and total sugar content of this new product, small samples must be used so that the reducing sugar results will fall within the Munson and Walker tables. In order to be able to use a larger sample a new column of 0.3 g total sugar was created, and since it is now possible to obtain very pure sucrose and dextrose, the original values of Munson and Walker were redetermined, and also the values for levulose. In this the conditions of the Munson and Walker method were rigorously followed, but with certain changes in technique. An extensive table showing the reducing sugar values for dextrose, levulose, invert solution, and for the sugar mixtures of 0.3 g, 0.4 g, and 2 g of total sugar has been prepared.

Spectrochemical testing.—Spectrochemical analyses were made of nearly 600 samples of metals, alloys, ores, precipitates, residues, chemical compounds, etc., entailing approximately 13,000 quantitative or semiquantitative determinations of chemical elements. In order to handle the rapidly increasing volume of spectrochemical testing requested by Government laboratories or agencies, various improvements in apparatus and technique have been made. An index to the literature of spectrochemical analysis, 1920–37, listing nearly 1,000 papers, was published by the American Society for Testing Materials.

Gloss classification for paint finishes.—To help establish uniformity in designating gloss of paints, the Bureau, in cooperation with the American Society for Testing Materials, has developed a method of test for gloss of paint finishes, together with a gloss-measuring instrument and a gloss classification based thereon. There is good agree-

ment between ratings with the new method and visual judgments of glossiness by paint experts.

Air mapping specifications.—Airplane photographs suitable for the construction of maps without excessive error must have the requisite metrical characteristics. An analysis of the relation between camera errors and the resulting map errors has been made in order to determine satisfactory tolerances for airplane cameras. The Bureau's lens-testing equipment has been rebuilt to permit measurements over the larger fields of view now covered by camera lenses. On the basis of a study of both camera requirements and available commercial lenses, detailed performance specifications have been prepared for airplane cameras.

Distribution of ozone in the stratosphere.—By means of a photoelectric ultraviolet radiometer and auxiliary radio-signalling apparatus, carried by unmanned balloons, information was obtained on the distribution of atmospheric ozone, which is highly opaque to ultraviolet rays and is concentrated in a layer having a maximum density at a height of about 25 kilometers above sea level. At the highest elevations attained (27 kilometers, 17 miles), the apparatus had passed through about 70 percent of the ozone layer. Also at a fixed ground station, measurements were obtained showing movement of the ozone layer and variations in the total amount of ozone with changes in barometric pressure (RP1207).

New laboratory for radioactive materials.—A laboratory has been developed and equipped for automatic testing of all types of weakly radioactive samples, whether solid, liquid, or gaseous. An exposure meter for radium radiations, designed to give to individuals working with radium automatic warning of excessive exposure, has been constructed and tested, and 1,287 radioactive preparations having a radium content of approximately 13,000 milligrams were certified. In addition, 1,551 preparations were received for the National Institute of Health, 377 of which have been certified to have a radium content of 2,940 milligrams.

X-ray standardization.—By means of a large ionization chamber, developed at the Bureau, filled with air at high pressure, X-ray dosage standardization has been extended up to an excitation potential of 400,000 volts. The pressure range of this chamber has been extended to 10 atmospheres. Using this chamber, dosage measurements of the gamma rays from radium have been satisfactorily made, thus furnishing the medical profession with reliable data to be used in X-ray treatments of cancer.

CHEMISTRY

Physical constants of pure substances.—Factors affecting the reproducibility of silver-silver halide electrodes, which are useful as reference electrodes, have been determined. A significant aging effect was found to occur before these electrodes attain their stable equilibrium potentials (RP1183 and, by invitation from the Polish Academy of Arts and Sciences, Roczniki Chemji 18, 762 (1938)).

The preparation of pure organic reagents and of organic compounds for optical crystallographic study was continued, and a method for determining the optical properties of microscopical crystals was further developed and used.

Methods for the preparation of very pure iridium by fractional precipitation with hydrogen sulfide and by recrystallization of ammonium chloroiridate have been systematically studied and developed to yield the element in reasonably satisfactory purity.

Methods for preparing oxygen free from nitrogen and other impurities are described in RP1182.

In cooperation with the University of Illinois, the study of the structure of unvulcanized and vulcanized rubber was continued. In this work, methods for the preparation of the materials and for their examination by means of X-rays have both been improved.

The permeability of neoprene to hydrogen, helium, and carbon dioxide was reported in RP1166. The permeability of neoprene is lower than that of rubber, apparently because of the stronger attraction of neoprene for the diffusing gas, which retards its passage. The use of neoprene for the gas cells of airships would, therefore, help to conserve our helium supply.

Thermochemistry.—Measurements were completed of the heats of combustion of cyclopropane, 2-methylbutane, normal hexane, and 2-methylpentane. Values were calculated for the heats and free energies of formation of water, carbon monoxide, and carbon dioxide.

Constitution of petroleum.—Work in cooperation with the American Petroleum Institute on the separation of petroleum into its ultimate constituents led to the following results: The separation of five new hydrocarbons from petroleum: 1,2-dimethylcyclopentane, 1,3-dimethylcyclopentane, normal propylbenzene, normal dodecane, and naphthalene; the assembly and testing of a centrifugal rotary distillation column; the assembly of three extraction columns for separating aromatic hydrocarbons from paraffins and naphthenes in the kerosene fraction; and the assembly of an apparatus for lubricating oil.

Methods of analysis.—New and improved methods of inorganic chemical analysis were published on: The determination of boron in steel and cast iron (RP1120); the volatilization of metallic compounds from solutions of perchloric or sulfuric acid (RP1198); and the electroanalytical determination of copper and lead in nitric-acid solution containing small amounts of hydrochloric acid (RP1213).

Progress on the analytical chemistry of the platinum metals has been along the lines of: (1) The development of methods for dissolving refractory platiniferous materials; (2) the separation of the platinum metals from base metals; and (3) a study of the conditions which govern the complete precipitation of iridium as sulfide.

In July 1938 the Bureau purchased the rare-earth collection of the late Professor James of the University of New Hampshire. Work is under way on the identification and purification of the 475 samples in the collection, in connection with which a vacuum X-ray spectrometer, a photoelectric colorimeter, and a magnetic balance have been constructed. Oxides of samarium, praseodymium, and neodymium were purified and used in the manufacture of special glasses for use as light filters.

Developments in the field of gas analysis included: (1) A gasometric method for analyzing fumigating mixtures of ethylene oxide and carbon dioxide (RP1175); (2) a new type of apparatus for producing finely divided bubbles of gas in a liquid absorbent (RP1214); (3) the construction and study of a new type of apparatus for very

accurate measurements of gas depending on displacement with a plunger; (4) the development of an apparatus for the rapid and simple control of furnaces and oxygen tents; and (5) an investigation of methods for the determination of mercury vapor in air.

The polarograph has been investigated as a tool for analytical determinations and has been found suitable for the estimation of certain biologically important compounds which are difficult to measure otherwise (RP1211).

Electroplating.—Work on electroplating included a study of methods for determining the active acidity of alkaline cyanide plating solutions and computations of the effects on current distribution of the shapes and positions of the electrodes in several typical solutions.

Extensive exposure tests of plating on steel, brass, and zinc die castings were completed in cooperation with the American Electroplaters Society and the American Society for Testing Materials. These furnish definite information on the corrosion resistance of different metals and alloys when exposed under varying atmospheric conditions.

Special investigations.—An investigation of 14 commercial types of apparatus, employing 7 essentially different methods of determining gas density, is in progress.

The effects on the accuracy of laboratory "wet" gas meters caused by failure to level properly and to saturate gases completely were investigated. It was found that, in general, the errors thus introduced are small.

An investigation of the technical questions involved in the dilution of natural gas with flue gas by a public utility was made for the city of Columbus, Ohio.

A method was developed for making satisfactory vacuum-tight seals between platinum and Pyrex glass, using thin-walled tubing which will not pull away from or break the glass to which it is attached.

In line with the adoption of color standards for the 48 States, the paint laboratory cooperated with the Bureau of Public Roads in the development of a new Federal yellow color for use in highway signs, and with the Optics Division of this Bureau in the development of a "national school bus chrome" for use on school-bus bodies.

Standard samples.—The Bureau prepared a renewal sample of high-chromium-high-nickel steel, and added 5 new standard samples to its stock. These comprised samples of high-nickel steel, high-sulfur steel, lead-bearing steel, ounce metal, and soda-lime glass. Stocks are now on hand representing standard samples of 118 different kinds. Approximately 8,300 individual samples were sold during the year. They are used in controlling and checking the analytical processes in commercial laboratories.

MECHANICS AND SOUND

Compressive properties of thin sheet material.—A procedure for determining the compressive properties of thin sheet material has been developed in cooperation with the National Advisory Committee for Aeronautics and the Bureau of Aeronautics, Navy Department. A number of small rectangular pieces cut from the same sheet are assembled into a "pack," like a pack of cards, and tested as

a solid specimen. The two outer faces are restrained to prevent lateral buckling (N. A. C. A. Technical Report 649). Using the pack method, the compressive properties of many aircraft metals have been determined. In most cases, pronounced differences were found between the compressive properties and the tensile properties.

The test equipment has been duplicated by a manufacturer and successful results have been obtained. Another manufacturer is experimenting with heat treatments to reduce the differences in compressive properties with direction of rolling that were found by pack tests. Application of the pack method may, therefore, result in the production of sheet material of high and uniform compressive properties. This, in turn, would lead to more efficient airplane construction.

Engineering instruments and appliances.—Some 1,400 engineering instruments were calibrated during the fiscal year, principally for the various engineering bureaus of the Government and the Bureau of Internal Revenue. Investigations and tests were made of numerous appliances, including fire-extinguishing equipment offered for the approval of the Bureau of Marine Inspection and Navigation; automatic mail-metering devices for the Post Office Department; elevator safety devices for the Federal and State governments; and a variety of heating, office, and miscellaneous appliances for the Federal bureaus.

Aircraft instruments.—Lubricants for timepieces, and methods for controlling and measuring humidity have been investigated as part of a research program for the Bureau of Aeronautics, Navy Department. In addition, compass test equipment was developed and specifications prepared for altitude barometers, electric tachometers, true airspeed indicators, and resistance thermometers.

In cooperation with the National Advisory Committee for Aeronautics, a paper on rate-of-climb indicators was prepared. Investigations of the effect of vibration on aircraft instruments and on the performance of corrugated diaphragms have been continued.

Aerodynamic investigations.—Fundamental studies of air flow, an understanding of which underlies all successful aircraft design, were continued with the cooperation of the National Advisory Committee for Aeronautics.

Acoustics.—Measurements of sound absorption have been made on 113 large and 82 small samples, and measurements of sound transmission have been made for 28 panels. Engineering advice has been given and tests made for other Government departments and State agencies on noise reduction, acoustic treatment of rooms, and sound-motion-picture equipment.

Model of flood spillway for Indian Rock Dam.—Model tests have been conducted for the U. S. Corps of Engineers on the tunnel and flood spillway for the Indian Rock Dam that is to be built on Codorus Creek to protect the city of York, Pa., against floods. Two models were built, the first a general model of the spillway and tunnel and of the adjacent portions of the reservoir and downstream river bed (scale 1:60) and the second a more detailed model of the tunnel (scale 1:22.4). The tests showed that the original design was satisfactory, except in regard to the stilling basins for the spillway channel and the tunnel. Numerous modifications of these stilling

basins were built and tested until a satsfactory combination was found.

Miscellaneous hydraulics.—Reports were completed on pressure losses in 90-degree pipe bends (RP1086), turbulent flow in open channels (RP1151), flashboard pins (Proc. Am. Soc. Civil Eng., May 1939), and artificial stream controls. Work is in progress on a number of other projects, including aging of pipes, density currents, theory of flood waves, measuring flumes, and dredge suction boosters.

ORGANIC AND FIBROUS MATERIALS

Quality of book papers.—Book papers are made today from many kinds of raw materials—fibers, fillers, sizing agents, coating compounds—unheard of a generation ago. While these changes were adopted because they were improvements in certain respects, little was known about their effects on the quality of the paper.

In order that the effect of changes in each of the constituents might be determined, it was necessary for the Bureau to make some 70 experimental papers in its own mill. These papers, besides being tested for the usual properties, were all printed at the Government Printing Office, in order that their relative suitabilities for use could be determined. They were also put through the Bureau's accelerated aging test, to determine which of them might be relied upon in the printing of permanent records. The results, as set forth in two publications (RP1149 and RP1180), are now available as a guide for paper manufacturers and users.

Consumer standards for leather goods.—Two factors enter into the value of a leather article to the consumer: How well is the article able to perform the intended service, and how long will it last?

The first question can be answered by careful measurement of those properties involved in the service. Until recently, the industry has had no standard methods for measuring such important properties as flexibility, tensile strength, and tearing resistance. Under the leadership of the Bureau, the American Leather Chemists' Association is now developing such standard methods. Four have been accepted, and seven more are now being investigated in the laboratory.

Since leather, in common with most organic materials, deteriorates on exposure to ordinary atmospheric conditions, the life of a leather article will depend upon this rate of natural deterioration, plus whatever acceleration thereof may be caused by service. The Bureau has found that the rate of natural deterioration is directly dependent upon the acidity of the leather, whether this acidity be created by the tanning process or by absorption of acidic gases from the atmosphere. A measurement of acidity therefore gives a good indication of the life expectancy of leather. In addition, however, an accelerated aging test is being developed, which is dependent upon heating the leather in an atmosphere of oxygen under pressure.

A study of the effects of service has been started by the development of a machine to measure the abrasive resistance of sole leather. The Bureau has designed, built, and tried out such a machine and recommended it to the industry. It is now being investigated by others.

Examples of the year's work in other lines.—Of the 52 items covered by reports issued during the year, the following are enumer-

ated as typical: Physical testing of rubber; detection of oxidation in wool; standardization of a method for measuring the fluidity of dispersion of cellulose in cuprammonium solution; testing wrapping materials for permeability to moisture; methods of shoe construction and their classification; microscopy in the identification of fibers; quantitative estimation of furfural from pentose compounds; permanence of plastics.

METALLURGY

Aircraft metals.—The possible detrimental effect on structural metal parts resulting from prolonged fatigue stressing (short of failure) such as occurs in service has been investigated with special reference to a possible lowering of the impact resistance of fatigued members. By breaking unnotched specimens by tension-impact after fatigue stressing, indications have been obtained of a lowering in impact resistance of heat-treated steel under such conditions. The effect is most pronounced at low temperatures, e. g., −78° C. The conventional notched-bar impact test does not reveal this condition. Other studies of the shock resistance of aircraft steels at low temperatures have been made, especially as regards welding and grain-refining as a treatment for minimizing this effect of low temperature. The effect of chromium plating in lowering the endurance limit of propeller steels has been studied. Thick coatings have been found more harmful than thin ones. The surface treatment of magnesium has been investigated in cooperation with manufacturers and interested naval agencies. Materials such as corrosion-resistant steel, which owes its high strength to cold working rather than heat treatment, find important applications in aircraft. As a result of a study of the elastic properties of this class of material, two reports have been prepared on the tensile elastic properties of "18–8" stainless steel and nonferrous alloys as affected by plastic deformation and by heat treatment. The Bureau has examined wreckage to aid Governmental agencies in the investigation of disastrous airplane crashes.

Corrosion of metals.—Corrosion determines in large measure the useful life of many industrial metals. Two series of long-time tests of pipe materials have continued throughout the year. In one, commercial piping, both ferrous and nonferrous, installed in the various service lines of the Bureau, has been under constant observation. In another, ferrous piping, the subject of much commercial controversy, is subjected to continuous flow tests in Washington water. Scheduled tentatively for 5 years' duration, the tests have been in progress for 3 years, examinations being made at intervals of a few months.

The air-conditioning industry has introduced some serious corrosion problems. Because of the repeated use of the cooling water, it becomes very corrosive by reason of the impurities washed from the air. A report on the fundamentals involved in the necessary chemical treatment to inhibit corrosion of iron or steel from this source will soon be ready.

Corrosion problems peculiar to aircraft have been studied, and a report on a series of continuous weathering tests of 5 years' duration on aluminum and magnesium alloys in sheet form was completed. Tests of the newly developed light alloys of aluminum and magnesium and of sheet "stainless" steel were started. These include in-

termittent wetting with sea water (tide-water tests) in addition to weathering under marine conditions. High-strength aluminum alloys must be heat treated, and, if the heat treatment is not done properly, the alloy may be susceptible to embrittlement as a result of intercrystalline corrosion. A method which promises to be very useful, consisting essentially of measurement of the electrolytic solution potential of the material, has been perfected for determining, in advance of service, the susceptibility of such heat-treated structural aluminum alloys to intercrystalline corrosion and embrittlement.

Ferrous metals.—The study of the elastic properties of cast iron by a method previously developed (RP1176) has been extended to the new types of high-strength alloy cast iron. The effects of conditions in casting, such as superheating and pouring temperatures, have been evaluated. Determinations of the basic properties of high-purity iron are in progress. The report describing the preparation of this high-purity iron, carrying a metallic impurity of less than 0.002 percent (total impurity, largely oxide, 0.01 percent), has been prepared (RP1226).

The extreme precautions found necessary in the melting of the high-purity iron in order to avoid contamination from the container led to a search for more satisfactory crucibles, and finally resulted in perfecting a method for producing crucibles by slip-casting (RP1236). This has been applied to all of the useful refractories.

To help overcome the inconsistent results obtained in determinations of hydrogen in ferrous materials, a modified procedure has been developed by which evacuation of the apparatus can be completed in 5 to 10 minutes. As part of the continuing investigation of the quality of carbon steels, a report has been completed on factors determining the capacity of high-purity iron-carbon alloys for hardening on heat treatment (RP1225). Thermal analyses have failed to show any significant effect of grain size on critical-point reactions on cooling, such as might affect the heat treatment of steel by quenching. The study of the theoretical aspects of the heat coloring of steel (RP1221) having been completed, attention is now being directed to the practical methods and applications of the process.

Cooperation in the welding program of the United States Navy Department has required a series of bend tests at different temperatures, hardness surveys of welded sections, and microstructural examinations of 21 low-alloy structural steels to determine their suitability in the general program. Ductility, as measured by elongation and reduction of area in a tensile fracture, has been correlated with other physical properties of various ferrous metals and one aluminum alloy. A steel plate made in the United States has been developed for the Bureau of Engraving and Printing. It is being used to replace the foreign material formerly considered necessary for mechanical transfer.

Nonferrous materials.—An X-ray study of the development of the fibrous condition in metals by cold working (RP1210) has shown that, in the case of single crystal copper, this depends upon the initial crystalline orientation with respect to the axis about which the cold working of the material is distributed. Cooperation has continued with the Non-Ferrous Ingot Metal Institute in an investigation of the significant factors underlying the commercial properties of copper

base ingot metals (RP1215). Impurities which may give rise to hot-shortness in the casting of such alloys are now under study.

With the completion of the equipment for determining the "creep" of metals at elevated temperatures, tests have been started on two single-phase nonferrous metals, copper-nickel alloy (monel), and high-purity copper. The durability of soldered joints in copper pipe for plumbing is receiving attention in cooperation with the Copper and Brass Research Association and American Standards Association. Sustained loading tests up to 325° F. have shown the relative merits and limitations of the different types of "soft" solders available for the purpose.

With the beginning of the third year of the cooperative research on new industrial uses for silver (American Silver Producers), the objectives of the program have been rather clearly defined. These include silver as (*a*) coating material for food and other containers, (*b*) electrical contacts, (*c*) fungicides, and (*d*) as an alloying addition for improving present commercial alloys.

CLAY AND SILICATE PRODUCTS

Optical and other glasses.—Experimental melting of four kinds of optical glass for the Navy Department led to a further increase in yield. Fifty melts gave 8,422 pounds (38,215 "blanks") of first-quality optical glass against 62 melts and 8,400 pounds last year.

Preliminary tests of the relative strength of various kinds of laminated safety glass (not exceeding three-eighths inch thickness) for use as windshields of aircraft showed that best results were obtained with two sheets of $\frac{3}{16}$-inch case-hardened plate glass laminated with one layer of "vinyl plastic," the next best being ¼-inch and ⅛-inch case-hardened glass similarly laminated.

The behavior of the "glass electrode" has been found to depend on the solubility of glass from which the electrode is made. The data are given in RP1187, which also suggests an explanation for voltage departures which are characteristic of this useful tool.

Forty-two special glasses were made to obtain data on the effect of certain unusual glass-forming oxides on density, refractivity, color, and expansivity. Twenty-two of these, containing oxides such as those of thorium and gadolinium were colorless, while 20 colored glasses were made with oxides of holmium, samarium, erbium, etc.

An investigation of the toxicity of colored glazes (RP1196) indicates that of the glazes tested, two glazes used in tableware (a green glaze containing copper and lead and tangerine, a lead glaze) constitute probable health hazards. Constant surveillance, using the indicated control tests, is necessary to guard against undesirable glazes being placed on the market.

The properties of 20 refractory air-setting mortars of the wet type were studied. The setting time, strength, type of failure of brick and mortar assemblages, and tendency of mortar to shrink, crack, and flow when exposed to high temperatures were also determined (RP1219).

Vitreous (porcelain) enamels were proved to be stronger in dry than in damp atmospheres; hence, humidity should be controlled in strength tests. A method was developed for determining resistance to chipping in torsion; also an apparatus and method for determin-

ing the internal strength of enamel coatings in resisting gouging and scratching.

A definite relation has been found between pore size and the number of cycles of freezing and thawing that bricks will stand without failure. Resistance is least when pores are small and highest when they are large. Water permeability increases with time of flow in bricks having a mean pore radius.

Low-cost glazes were developed for eight clays obtained from different localities, using glaze compositions containing in each case the maximum permissible amount of the same clay as that to which the glaze was applied. By adding different coloring oxides to the clear glazes, a series of colors was made in "jet black," orchid, cream, and different shades of blue, green, yellow, and brown.

Cement, lime, and gypsum.—New refrigerating equipment was installed for accelerated weathering tests of concrete and other masonry materials. For evaluating disintegration produced in concrete by freezing and thawing tests, a sonic apparatus has been developed which enables rapid determination of the modulus of elasticity without affecting the specimens.

Measurement of the relative humidity at various points within a mass of concrete, by means of an electric hygrometer developed at the Bureau, has been found the most promising for determining moisture content.

Among the possible products of autoclave treatment of portland cement are crystalline hydrated calcium silicates. An X-ray study of most of the naturally occurring minerals of this group has, therefore, been made, and a number of them have been synthesized. A new low-temperature form of anhydrous tricalcium disilicate was discovered (RP1147).

In a study of the effects of various mineralizers which promote the formation of the calcium silicates in portland cement, it was found that magnesium fluosilicate was far more active than any other material used.

Members of the Bureau's staff, cooperating with the engineers of one of the lime companies, have demonstrated that the commercial production of a completely hydrated dolomitic lime of satisfactory keeping quality, by autoclave treatment, is a practical proposition.

The study of the crystalline and amorphous phases of portland cement clinker has continued in cooperation with the Portland Cement Association, and some of the reactions of potash in cement compositions have been determined (RP1131). The effect of the glassy phase on the heats of hydration of portland cement at 3, 7, and 28 days has been measured (RP1127).

Branch laboratories.—More than 7,000,000 barrels of cement were tested for the Federal Government by the Bureau and its branch laboratories at Seattle, Wash.; San Francisco and Riverside, Calif.; Denver, Colo.; and Allentown, Pa. This is an increase of a million barrels over the previous year.

Cement Reference Laboratory.—The Cement Reference Laboratory, a cooperative project of the Bureau and the American Society for Testing Materials, has announced a sixth inspection tour, and almost 300 laboratories have requested inspection.

Because of the widespread interest in the results of earlier comparative tests of the same sample of cement by various laboratories, plans for a third test were announced; 220 laboratories have requested the sample. A second series of tests of special cements was undertaken for the American Society for Testing Materials Committee C–1 on Cement.

Deformation of a three-hinged concrete arch.—In cooperation with the Bureau of Yards and Docks, Navy Department, measurements were made of the temperatures and crown deflections and rotations of a three-hinged reinforced concrete arch having a span of 110 feet at the Navy's ship-model basin at Carderock, Md. When exposed surfaces were coated with a black compound the daily change in the temperature gradient within the concrete was as much as 3.6° F. per inch, the crown deflection 2 inches; after coating with aluminum paint, they were about half as large. In accordance with theory, the deflections caused by daily changes in temperature gradients between the upper and lower surfaces of the arch were much greater than those produced by changes in the average temperature of the concrete.

Durability of brick and brick masonry.—Studies of the relation between the results of laboratory tests and resistance to weathering of clay brick show a useful correlation between rate of disintegration during weathering and the performance of bricks in laboratory tests.

Physical properties of granite.—Results of studies on physical properties of various granites have been assembled for a publication which should be available in the near future. This will include results on the principal building and monumental granites of the United States and will supply information that is frequently requested.

SIMPLIFIED PRACTICE

New and revised recommendations.—Thirteen simplified-practice recommendations, of which 2 were new, were printed and placed on sale. Eight existing recommendations were revised for reissue, and 18 others were officially reaffirmed following the customary surveys. Similar surveys of 7 existing recommendations were commenced to determine whether they are in need of revision, work was started on 6 newly proposed simplification projects, and an effort was made to expedite completion of several projects which have required an exceptional amount of study and organization.

Food containers.—A variety-survey, to determine the basis for revising R155–37, Cans for Fruits and Vegetables, started last year, was completed in June. This project is unique because of the fact that the revision was drawn up in terms that conform to the broad intent of proposed national legislation, as specified in a bill relative to the use of metal containers for food products, now before the Committee on Coinage, Weights, and Measures of the House of Representatives.

Revisions.—Consumers as well as manufacturers and distributors continue to utilize the cooperative procedure of the Division for revising recommendations which have been in effect for many years. The recent sixth revision of R31, Loaded Paper Shot Shells, exemplifies this. Successive revisions have progressively reduced the

variety of shells until now only 6.5 percent of the varieties originally manufactured are being made.

Simplified Practice Recommendation R163, Coarse Aggregates (crushed stone, gravel, and slag), promulgated in May as a revised recommendation, is noteworthy because of its importance to Federal, State, and local Government agencies. The recommendation affords an example of simplification in a technical field, as contrasted with recommendations covering articles in trade.

TRADE STANDARDS

New commercial standards.—The voluntary development of commercial standards for the following commodities received special attention: Mechanical-draft oil burners, light and signal equipment for motor vehicles, women's dress sizes, colorfastness of fabrics, water-repellent fabrics, moth-repellent materials, artist oil paints, and hardwood interior trim.

Commercial standards printed.—Thirteen commercial standards were released in printed form and eight were promulgated in mimeographed form, including Douglas-fir plywood; ground-glass joints, stopcocks, and stoppers; marking of gold-filled articles; fuel oil; wood shingles; dress patterns; woven dress fabrics—testing and reporting; solid hardwood wall paneling; boy's button-on waists, shirts, junior and polo shirts.

Conferences.—Thirty-nine conferences were held with groups interested in the voluntary establishment of standards for a wide range of commodities. Written acceptances of commercial standards, as the standard practice in buying and selling the products covered, were received from responsible officers of 3,315 organizations.

Douglas-fir plywood.—The revision of CS45–38, Douglas-Fir Plywood, promulgated during the year, provided for the first time two specific classes of moisture resistance, with methods of test for each. The exterior class marked "Ext" is intended for use on the exterior of buildings. After several cycles of alternate wetting and drying, this exterior class must pass a shear test in order to bear the exterior "Ext" designation.

Another method of test is specified for the moisture-resistant, "M. Res.," class. This provides a basis of assurance for builders, home owners, retailers, lending agencies, and Federal insuring agencies that the quality conforms to the requirements of the standard. This commercial standard also includes requirements for the various grades and types, the standard sizes, size tolerances, inspection rules, grade marking and certification, and definitions for the various terms used.

Federal specifications.—Commercial standards are given full consideration by the various technical committees charged with the preparation and revision of Federal purchase specifications and serve to widen the use of the specifications and broaden the field of supply for the Government. Commercial standards that serve in whole or in part as the basis of Federal specification requirements include those for fuel oils, dry-cleaning solvent, vitreous-china plumbing fixtures, seats for water-closet bowls, pipe nipples and unions, and builders' hardware. Where there are no parallel Federal specifications, commercial standards are used by the various Federal agencies

for procurement purposes. A substantial share in the work on preparation and revision of Federal specifications is assumed by members of the Division who serve as officers of three technical committees on builders' and miscellaneous hardware; pipe, fittings, valves, etc.; and plumbing fixtures. Federal specifications have been prepared for plumbing fixtures, cast-iron pipe fittings, malleable-iron pipe fittings, cast-iron drainage fittings, ferrous pipe, padlocks, emergency exit devices, sprinkling cans, gate valves, globe valves, radiator air valves, and radiator supply valves.

CODES AND SPECIFICATIONS

Safety and building codes.—One of the important Bureau services to governmental agencies is the preparation of safety codes and building codes. Handbook H24, American Standard Safety Code for the Protection of Heads, Eyes, and Respiratory Organs, recently issued under the sponsorship of the Bureau, is a revised edition of an earlier code, the scope of which has been enlarged by the inclusion of rules for protectors intended to prevent the workers from inhaling gases, dusts, fumes, etc., which might be injurious to the lungs. Handbook H34, Safety Rules for the Operation of Electric Equipment and Lines, contains a recent revision of part 4 of the National Electrical Safety Code prepared under the sponsorship of the Bureau. Part 2 of this code, which is now being revised, will include a section relating to electric fences which are being rather widely utilized. When such fences are improperly designed or installed, they may become a serious life hazard. These codes are particularly helpful to State regulatory officials.

A survey was completed of all cities and towns in this country, having a population of 2,500 or over, to ascertain the age of local building codes in effect, what efforts were being made to bring them up to date, and what features were causing most concern. About 20 percent of existing local codes had not been thoroughly revised in 15 years.

A report entitled "Preparation and Revision of Building Codes" was issued. This is designed to be of the maximum possible aid to committees engaged in preparing or revising local building codes. If the legal restrictions imposed by public authorities do not recognize late developments in design and construction that have been found to be safe, they may cause unnecessary expense, prevent the free exercise of ingenuity in design, and discourage the introduction of new materials and methods. In this report a procedure is outlined through which full advantage may be taken of developments in the laboratory and in the field, while preserving the primary object of safeguarding the public. It is hoped that the Bureau's research on materials used in low-cost housing will make it possible to develop a standard procedure that will provide the necessary protection for the public and will permit the free introduction of new materials and methods on submittal of proper evidence that they meet acceptable standards.

Facilitating the use of specifications.—The total number of lists of sources of supply of commodities covered by Federal specifications and commercial standards was increased to 712, with requests for 25,173 separate listings from 13,593 firms. Information relating to

the certification plan and willing-to-certify lists, and copies of Federal specifications were sent in compliance with 1,901 requests from interested purchasing agents, other consumers, and manufacturers.

Services to tax-supported agencies and consumers.—Information dealing with standards and specifications and purchasing problems was sent to about 500 purchasing officials of State, county, and municipal governments and educational institutions.

Surveys were made of the certification and labeling activities of technical societies, trade associations, and 3,300 manufacturers covering a wide variety of industries, to determine the extent to which use is being made of quality-guarantee labels and certificates on goods entering into the over-the-counter trade.

BUILDING MATERIALS AND STRUCTURES

Structural properties of constructions.—The structural properties of 28 constructions intended for low-cost housing have been determined this year. Because there is but little information on the actual strength and stiffness of constructions for houses, the reports supply data which will assist architects and builders in selecting constructions of the lowest cost suitable for a particular building in a particular geographical location. The Forest Products Laboratory has cooperated in the testing of various types of wood construction.

Fire-resistant tests.—The fire resistance of several types of walls and partitions built of prefabricated panels was determined, and a series of fire tests of light partitions having plaster or board facings was completed. Further progress was made in determining the fire resistance of clay hollow-tile partitions.

Several types of light floor constructions, including wood joists supporting wood floors and steel joists with precast gypsum slabs or concrete subfloors were subjected to fire tests. In these constructions, the ceiling protection was plaster applied on metal or gypsum lath.

Rain penetration in masonry and waterproofing.—As part of the investigation of the rain permeability of masonry walls, 41 specimens have been built by sponsors of 15 different wall constructions; 128 other walls were built for use in the study of the effects of the type of units, method of filling joints, properties of mortar and brick, facings of stucco, and coatings of cement-water paint on water permeability. Waterproofings were applied to 19 walls.

Exposures of masonry walls to cycles of wetting and drying, or of heating and cooling, did not cause a significant change in their permeabilities. Several specimens are now being retested after having been exposed to the weather for 3 years.

Bond of mortar to brick.—The effects of variations in properties of bricks and mortar on the nature and durability of bond between them are being studied. The most important properties are rate of absorption for the brick and water retentivity and strength of the mortar. The quality of bond is measured by making tensile and shearing tests on brick-mortar specimens and by permeability tests on small panels.

Plastic calking compounds.—In the investigation of plastic calking compounds, simple tests for shrinkage, rate of hardening, bond, tenacity, slump, and staining have been devised, and the results of

these tests on numerous samples have been compared with those obtained with procedures used for the past 7 years. These comparisons, along with studies of the materials in service and in exposure tests simulating service, have led to a new proposed specification which should provide more satisfactory materials. Some of the tests can be used where laboratory facilities are not available.

In connection with a study of composition of calking compounds, about 200 experimental mixtures were made to obtain more information concerning effects of various ingredients on performance. Exposure tests are being made on several of these mixtures for comparison with similar results on proprietary compositions.

Roofing materials.—Two reports have been prepared summarizing the results of surveys, both urban and rural, on the weathering qualities and extent of use of roofing materials in the southeastern States as far south as Florida (BMS6) and in the northeastern States as far north as Maine (BMS29). These two surveys serve to emphasize forcibly different roofing materials predominating in the two sections and differences in their weathering characteristics. Cooperation has been continued with other Government agencies in obtaining data on roofing materials used in different sections of the country and their relative merits. Reports describing specific types of roofing materials in common use are in preparation.

Protection of steel against corrosion.—In the study of corrosion-resistant surface treatments and coatings for sheet steel, over 1,800 samples, plain and galvanized, have been tested by the methods previously described (BMS8)—weatherometer, controlled-condensation chamber, and salt-spray test, all supplemented by continuous outdoor exposure. Of the various pretreatments used for conditioning the surface prior to painting, those resulting in a surface phosphate film have shown outstanding merit in the tests. The situation with respect to the durability of the applied paint coating, however, is not a simple one. The evaluation of the durability of a paint coating may differ decidedly with the type of test used.

Building boards and papers.—New types of building boards and papers are constantly coming on the market. Builders are interested in knowing how these new materials compare with those with which they are familiar. Since building papers are used inside walls where they are exposed to extremes of humidity and temperature, and where their condition cannot be readily seen, it is important to know whether they may be expected to last during the life of the building.

The properties of 18 typical building boards have been reported (BMS13). In another report (BMS4) a description is given of the accelerated aging procedure devised to show how boards and papers will change after many years' service. The effects of such aging on 11 kinds of boards are described. A third report lists the properties of 21 typical building papers, before and after aging.

Floor coverings.—Accelerated service tests have been made by laying the floor coverings on sections of a circular track and subjecting them to the action of a steel-wheeled, heavily loaded truck, which is driven around the track continuously. The 20 sections of the track have been divided in half, so that 40 samples can now be tested at a time. This has permitted investigation not only of the floor coverings themselves, but also of the effect of wood and concrete subfloors,

the performance of different adhesives, and the value of underlays. The service tests are accompanied by laboratory tests of the flooring materials used, and a report on indentation and recovery has been issued (BMS14).

Plumbing.—Experiments were made to determine the sizes of the main vent or vent stack relative to the sizes of the soil stack and building drain required to protect the water seals of traps connected with branch drains. Various commonly used combinations of soil stacks, building drains, and vent pipes were used in these tests. In each combination the height of the installation was varied to represent building heights ranging from two to eight stories. Experiments to determine the safe limits of loop or circuit venting on 3- and 4-inch sloping branches were also completed during the year.

Air infiltration through windows.—Work was completed on a study of air infiltration through double-hung windows and light-steel casement windows as depending on the clearances between the moving parts of the window and the frame and on the wind pressure.

Rating of house-heating appliances.—Test methods for the rating of house-heating boilers and of radiators and convectors for use with them have not been fully standardized and the current practices did not meet the needs of the Government housing authorities. Accordingly, new tentative methods of rating have been adopted and tests have been made on 5 types of domestic heating boilers, 8 types of radiators, and 12 types of convectors. A preliminary report on radiators and convectors has been issued.

Experimental house for testing heating equipment.—Plans were drawn and construction specifications prepared for a five-room bungalow with adjustable ceilings to be used in testing low-cost heating equipment.

Effect of moisture on the thermal conductivity of insulating materials.—Measurements were completed on a number of typical insulating boards conditioned at various relative humidities. In general, it was found that the conductivity increased a little over 1 percent for each percent of moisture by weight.

Thermal conductivity tests using thick and thin specimens of insulating materials.—In the Bureau's laboratory tests to determine the thermal conductivity of insulating materials, comparatively thin sections have been used. Doubt has been expressed as to whether the results of these tests are a true indication of the conductivity of the materials in full thicknesses as used in an actual house. In order to settle this question, tests have been made in a new apparatus 3 feet square, using thick and thin test specimens of representative materials. It has been found that performance can be predicted equally well from thick or thin specimens of corkboard, vermiculite, and rock wool, but in the case of glass wool an unexplained difference exists.

Cement-water paints.—Approximately 130 experimental water paints of varying composition have been prepared in the laboratory. The wet and dry hiding power, spreading rate, water absorption, mixing, brushing, and hydraulic properties have been determined for about two-thirds of these paints. In addition, exposure tests, both outdoor and accelerated, are being made to determine the serviceability of such coatings under ideal and varying drying conditions. Outdoor exposure tests are also in progress on other types of masonry

paints, including those containing drying oils and emulsified synthetic resin.

Commercial standards.—Two commercial standards—CS74–39 for solid hardwood wall paneling and CS45–38 (third edition) for Douglas-fir plywood—were promulgated. The latter includes two classes of moisture resistance of special interest in low-cost housing. CS73–38 for old growth Douglas-fir stock doors was issued in printed form. After careful investigation and conferences with those interested proposed commercial standards were drafted for hardwood interior trim and molding, double-hung windows, panel and sash pine doors, and prefitted, double-hung window units. Preliminary studies were made on casement window units and fiber sheathing board. A proposed Federal specification for flush veneered doors was drafted.

Simplified practice recommendations.—In addition to the review and revision of recommendations in the field of building materials, work in cooperation with the Central Committee on Lumber Standards brought to practical completion a thorough revision of Simplified Practice Recommendation R16–29, Lumber, which establishes uniform provisions for the inspection and grading of softwood lumber. The provisions are used by the different lumber-producing groups as bases for their specific rules covering the several species.

GENERAL FINANCIAL STATEMENT

The amounts and objects of each appropriation for the past fiscal year, together with disbursements, liabilities, and balance for each appropriation, are shown in the following table:

Disbursements, liabilities, etc., 1939, 1938, and 1937 appropriations

Appropriations	Total appropriations [1]	Disbursements	Liabilities	Balance
Operation and administration [2]	$273,032.83	$253,318.04	$19,349.95	$364.84
Testing, inspection, and information service [3]	1,160,916.34	1,053,559.50	92,766.66	14,590.18
Research and development	700,000.00	692,043.26	7,532.24	424.50
Standards for commerce [4]	110,868.08	108,298.14	2,208.17	361.77
Investigation of building materials [5]	198,042.01	174,416.72	22,807.74	817.55
Electrical building and equipment	[a] 144,600.00	1,977.75	43,209.72	[b] 99,412.53
Appropriations transferred from other departments:				
Aviation, Navy [6]	125,694.00	123,866.35	1,477.37	350.28
Salaries and expenses, Bureau of Engraving and Printing	11,300.00	11,245.86	33.19	20.95
Distinctive paper for U. S. securities	2,000.00	1,995.50		4.50
Construction and repair, Bureau of Construction and Repair	8,500.00	8,483.90	6.53	9.57
Engineering, Bureau of Engineering	14,300.00	13,875.52	354.99	69.49
Incidental expenses of Army	10,000.00	9,665.55	204.94	129.51
Advisory Committee for Aeronautics	68,634.00	67,707.56	709.43	217.01
Conservation and use of agricultural land resources	3,000.00	2,976.61	7.63	15.76
Salaries and expenses, Soil Conservation Service	1,000.00	999.97		.03
Federal-aid highway system	300.00	300.00		
Salaries and expenses, Bureau of Biological Survey	300.00	300.00		
Land utilization and retirement of submarginal land	450.00	439.77		10.23
Salaries and expenses, Bureau of Agricultural Economics	150.00	150.00		
Salaries and expenses, Extension Service	200.00	175.00		25.00
Salaries and expenses, Office of Information	100.00	83.33		16.67
Salaries and expenses, Forest Service	500.00	468.96		31.04
Salaries and expenses, Bureau of Chemistry and Soils	200.00	108.33		91.67
Air Corps, Army	18,833.00	17,540.70	1,019.86	272.44
Civil Aeronautics Authority fund	11,886.43	11,017.60	834.49	34.34
Establishment of air navigation facilities, C. A. A	4,750.02	4,398.72	291.78	59.52
Salaries and expenses, Weather Bureau	4,000.00	3,802.29	172.88	24.83
Maintenance, National Cancer Institute	670.00	655.80		14.20
Safety and planning, Bureau of Air Commerce	413.16	413.16		
Establishment of air-navigation facilities, Bureau of Air Commerce	1,249.98	1,249.98		
Aircraft in commerce, Bureau of Air Commerce	702.48	702.48		
Appropriations transferred from other departments under the provision of the Legislative Act approved June 30, 1932:				
Working fund: Navy—Armor, Armament, and Ammunition	27,000.00	17,262.40	70.00	[b] 9,667.60
Working fund: Navy—Ordnance	21,000.00	20,946.85		53.15
Working fund: Treasury—Internal Revenue	6,000.00	5,929.45	20.00	50.55
Working fund: Navy—Aviation	4,900.00	4,532.80	220.58	146.62
Total, 1939	2,935,492.33	2,614,907.85	193,298.15	127,286.33
Total, 1938	2,774,942.00	2,687,992.82	1,352.27	[c] 85,596.91
Total, 1937	2,589,128.33	2,560,072.25	674.00	28,382.08

[1] Includes transfers from other departments and also reimbursements received and pending as shown under the following footnotes: [2] $32.83. [3] $323,856.60. [4] $868.08. [5] $42.01. [6] $481.00.

[a] Does not include $355,400 transferred to Treasury Department, Procurement Division, Public Buildings.

[b] Available in 1940.

[c] Includes administrative reserve of $73,640.

PATENT OFFICE

During much of the period since the last annual report, the Commissioner of Patents and his associates have been concerned with the study and formulation of legislative measures for the improvement of the patent system. This proposed legislation was presented to Congress in June and has promise of prompt and favorable action by the several committees to which it was referred. Meantime, enactment of the various betterments proposed has been urged by representatives of industry, large and small, by inventors, by the Patent Office Advisory Committee, and by the Business Advisory Council of the Department of Commerce.

The bills now awaiting congressional action have for their purpose to reduce the time and cost of issuing and litigating patents, and thus not merely to safeguard the rights of applicants and patentees, but also to serve the public interest by quick and final determination of questions affecting the users of patented inventions. One of the major objectives sought by one of the bills before Congress is the establishment of a single court of appeals for patents. This court, if created, would adjudicate issues involving ownership, validity, and infringement of patents arising in any part of the United States and its territories, and by the uniformity and universality of its decisions would obviate the delays, conflicts, confusion, and burdensome expense at present attending the adjudication of such questions by the 10 Circuit Courts of Appeals.

Passage of the other measures mentioned would expedite the prosecution and issuance of applications for patent and correct certain abuses which the existing statutes fail to prevent or to remedy.

The Patent Office was for several months in continuous cooperation with the Temporary National Economic Committee during the latter's inquiry into the "concentration of economic power" insofar as such centralization was alleged to be furthered by the use or misuse of patents. The Commissioner, in the course of his testimony before the Committee, presented statistics and other facts needed for its information and guidance, and also arranged for the introduction of evidence by inventors, engineers, manufacturers, and others having special knowledge of the subjects under inquiry.

It was after this Committee's hearings that the several bills were submitted to Congress by the Secretary of Commerce.

RECEIPTS AND EXPENDITURES

For the fifth time in the last 6 years the Patent Office records a surplus. In that period these surpluses have averaged $102,388 annually. For 10 years prior to 1934 the succession of deficits ranged from $134,433 to $827,342. There was a deficit of $78,364.52 in 1936, attributable to increases in the salaries of examiners. The receipts of the Office during the fiscal year 1939 were $4,742,617.26, and the expenditures were $4,615,505.11.

The number of applications for patents (including reissues) and for registration of trade-marks, prints, and labels filed in the 12 months covered by this report was slightly less than the aggregate received in 1938, but with that exception their total was greater than that for any previous year since 1931. In the latest fiscal period 91,163 such applications were received, as against 92,018 in 1938. Further increase was shown in the number of design patents granted in 1939. The number of such patents issued was 5,154, the largest in the history of the Office. It seems pertinent to repeat the statement included in a previous report, namely, that manufacturers and merchants continue to have larger recourse to this form of protection for their goods.

CONDITION OF THE WORK

While the inflow of new applications was only slightly less in 1939 than in 1938, there was notwithstanding an acceleration in their dispatch. The total number of cases disposed of was 69,243, or 9,075 more than in 1938. Cases awaiting action by the examiners at the end of the latest fiscal year were 42,215, as against 45,723 on June 30, 1938. The total of applications pending at the close of 1939 was 113,277, or 2,764 fewer than on June 30, 1938.

At the close of the year 1939 the work of 11 examining divisions was within 3 months of current. Of the remaining divisions, 19 were between 3 and 4 months in arrears, 16 divisions between 4 and 5 months, 15 divisions between 5 and 6 months, and 4 divisions between 6 and 7 months.

CLASSIFICATION OF PATENTS

Prompt and correct classification of patents is one of the requisites of accurate and expeditious determination of the patentability of inventions sought to be patented. The work of creating new and revising old classifications has been prosecuted with as much dispatch as serious difficulties would allow, and considerable progress has been made. Not only the Office itself but inventors and industry will benefit by the revisions accomplished.

Because of retirements, death, and transfer it was necessary to replace the classification examiner and a number of the examining staff of the Classification Division during the past year. The new examiners will develop increased capacity for classification work as they gain experience in this field. Since the last report four new classes (57, 109, 174, and 288) containing 13,431 original patents and 14,885 cross-references have been revised and the work on class 152, containing 15,055 original patents and 12,298 cross-references, was completed. A new classification of rubber compositions comprising 114 subclasses containing 2,607 original patents and 2,136 cross-references was completed and added to class 260. In addition, 302 subclasses, containing 7,718 original patents and 8,149 cross-references, were established in various existing classes and 48 subclasses, containing 3,814 originals and 2,192 cross-references, were abolished and the patents transferred to existing classes. Miscel-

laneous patents to the number of 2,772 were transferred to more appropriate classes and 3,266 cross-references were made in the various classes to facilitate searching.

The weekly issue increased approximately 15 percent over the previous year, causing an increase in the time consumed in checking. In connection with the weekly issue, 42,320 cross-references were made.

Personal interviews with examiners and other employes of the Office on matters of classification or division and inquiries as to fields of search average over 700 per month; and with attorneys and others not connected with the Office, more than 400 per month.

Reclassification work in process comprises 25 classes.

PATENT OFFICE ADVISORY COMMITTEE

This Committee, with the cooperation of the Commissioner and other officials, continued its monthly meetings during 1938–39. Many subjects relating to the internal administration of the Office, as well as to the patent laws, were considered and discussed at these meetings. The result of part of the Committee's activities was embodied in a report transmitted to the Secretary in December 1938. This report presented a program of revision of the patent laws, with an analysis of the reasons for the changes proposed. The Committee also cooperated with the Commissioner in the hearings before the Temporary National Economic Committee. The meetings in 1939 continued with the study of internal procedure of the Patent Office, particularly of interference practice.

The present members of the Advisory Committee, all of whom serve without compensation and bear the expenses incident to their attendance at frequent meetings in Washington, are: George Ramsey, of New York, N. Y., chairman; John J. Darby, Washington, D. C.; John A. Dienner, Chicago, Ill.; Gano Dunn, New York, N. Y.; Dean S. Edmonds, New York, N. Y.; Franklin D. Hardy, Pittsburgh, Pa.; Delos G. Haynes, St. Louis, Mo.; Herman Lind, Cleveland, Ohio; Robert Lund, St. Louis, Mo.; John D. Myers, Philadelphia, Pa.; Fin Sparre, Wilmington, Del.; Milton Tibbetts, Detroit, Mich.; Charles E. Townsend, San Francisco, Calif.; and W. W. Wheeler, Hartford, Conn.

SPECIAL CASES

During the last fiscal year there were received 361 petitions from applicants seeking to have their applications examined out of turn in accordance with the practice of according such special status when there is a prospect that the issuance of a patent would result in investment of capital and the employment of labor in the manufacture of inventions covered, or would otherwise be of public benefit.

The total of such petitions was 95 more than that received in 1938. Of the petitions filed in 1939 there were granted 175, of which 95 received such favorable consideration in the interest of prospective manufacture necessitating original or additional use of capital and labor.

STATISTICS

Following is presented the usual statistical information regarding the activities of the Patent Office.

Applications received during the fiscal year ended June 30, 1939[1]

With fees:		
Applications for patents for inventions	66,166	
Applications for patents for designs	7,603	
Applications for reissue of patents	384	
		74,153
Applications for registration of trade-marks	[2]14,321	
Applications for registration of labels and prints	2,689	
		17,010
Total, with fees		91,163
Without fees:		
Applications for inventions (act Mar. 3, 1883)	395	
Applications for reissue (act Mar. 3, 1883)	2	
Applications for reissue design (rule 170)	1	
Total, without fees		398
Grand total		91,561

Applications for patents for inventions with fees

Year ended June 30—		Year ended June 30—	
1930	91,430	1935	56,832
1931	84,097	1936	59,809
1932	73,465	1937	63,772
1933	59,408	1938	66,050
1934	56,095	1939	66,166

[1] Including applications in which fees were refunded and transferred.
[2] Includes 1,151 applications for renewal of trade-mark registrations.

Applications for patents, including reissues, designs, trade-marks, labels and prints, with fees

Year ended June 30—		Year ended June 30—	
1930	117,569	1935	81,000
1931	106,717	1936	85,102
1932	93,859	1937	89,980
1933	79,469	1938	92,018
1934	79,367	1939	91,163

Patent applications awaiting action

June 30—		June 30—	
1930	119,597	1935	31,920
1931	92,203	1936	33,540
1932	76,723	1937	38,121
1933	49,050	1938	45,723
1934	39,226	1939	42,215

Patents withheld and patents expired

	1938	1939
Letters patent withheld for nonpayment of final fees	4,846	5,158
Applications allowed awaiting payment of final fees	15,949	16,736
Patents expired	38,082	39,004
Applications in which issue of patent has been deferred under sec. 4885 R. S.	490	618
Applications in process of issue	2,865	3,455

Patents granted and trade-marks, labels, and prints registered

	1935	1936	1937	1938	1939
Letters patent	41,621	39,978	39,412	36,672	41,908
Plant patents	28	61	65	28	52
Design patents	3,437	4,174	4,939	5,142	5,154
Reissue patents	400	400	405	343	359
Trade-marks	11,109	10,777	11,329	10,529	10,591
Labels	1,908	1,787	1,955	1,806	1,770
Prints	500	519	551	609	545
Total	59,003	57,696	58,656	55,129	60,379

Statement of receipts and earnings for the fiscal year ended June 30, 1939

Unearned balance at close of business June 30, 1938		$204,439.13	
Collections during fiscal year ended June 30, 1939		4,557,900.42	
Total		4,762,339.55	
Refundments		19,722.29	
Net collections			$4,742,617.26
EARNINGS			
Inventions, first fees	$1,980,570.00		
Extra claims	31,426.00		
Reissues	11,400.00		
Designs	79,010.00		
Design extensions	33,275.00		
Trade-marks	211,630.00		
Labels and prints	13,926.00		
Total		$2,361,237.00	
Final fees	$1,270,301.00		
Extra claims	19,055.00		
Total		1,289,356.00	
Appeals	$71,085.00		
Oppositions	11,340.00		
Disclaimers	2,060.00		
Revivals	3,280.00		
Total		87,765.00	
Printed copies, etc	$411,630.79		
Photoprints	10,602.20		
Photostats	63,998.50		
Manuscript	121,625.45		
Certified printed copies, etc	6,824.30		
Recording articles of incorporation	1,066.00		
Recording international trade-marks	20.00		
Registration of attorneys	905.00		
Total		616,672.24	
Drawings		19,763.97	
Assignments		151,242.30	
Court costs refundments		1,255.65	
Total earnings			$4,527,292.16
Unearned balance June 30, 1939			215,325.10
Net receipts			4,742,617.26

Expenditures, fiscal year ended June 30, 1939

Salaries		$3,534,851.65
Photolithographing:		
Current issue, black and white	$42,884.16	
Current issue, color	10,528.25	
Reproduction, black and white	75,465.30	
Reproduction, color	48.50	
Photographic printing	15,113.00	
Photostat supplies	27,626.65	
Total		171,665.86
Miscellaneous expenses		53,976.24
Printing and binding:		
Specifications	$687,670.60	
Official Gazette	104,454.52	
Indexes	10,195.59	
Total		802,320.71
Miscellaneous		52,033.80
Travel expenses:		
Public use, etc	$587.20	
Commissioner	69.65	
		656.85
Total		4,615,505.11

Receipts and expenditures

Receipts from all sources	$4,742,617.26
Expenditures	4,615,505.11
Surplus	127,112.15
Receipts from sale of Official Gazette and other publications (Superintendent of Documents)	72,329.17

Comparative statement

June 30—	Receipts	Expenditures	Deficit	Surplus
1930	$4,096,825.43	$4,552,685.41	$455,859.98	
1931	4,565,377.08	4,832,277.96	266,900.88	
1932	[1] 4,487,508.78	5,314,851.59	827,342.81	
1933	[1] 4,423,563.18	4,588,585.02	165,021.84	
1934	[1] 4,383,468.11	3,876,785.01		$506,683.10
1935	[1] 4,264,874.67	4,153,591.21		111,283.46
1936	[1] 4,368,099.17	4,446,463.69	78,364.52	
1937	[1] 4,565,501.69	4,492,273.47		73,228.22
1938	[1] 4,551,298.87	4,476,913.25		74,385.62
1939	[1] 4,742,617.26	4,615,505.11		127,112.15

[1] This does not include the amount received by the Superintendent of Documents for the Official Gazette and other publications.

Comparative statement of expenditures under separate appropriations

Appropriation	1938	1939
Salaries	$3,377,620.08	$3,534,851.65
Photolithographing	170,229.05	171,665.86
Printing and binding	809,796.78	802,320.71
Miscellaneous printing and binding	72,863.48	52,033.80
Miscellaneous expenses	46,403.86	53,976.24
Travel expenses		656.85
Total	4,476,913.25	4,615,505.11

Litigated cases

Patent:			
Interferences declared			1,232
Interferences disposed of before final hearing			1,245
Interferences disposed of after final hearing			234
Interferences heard			228
Interferences awaiting decision			25
Trade-mark:			
Interferences declared			95
Oppositions instituted			1,140
Cancelations instituted			147
Interferences disposed of before final hearing			907
Interferences disposed of after final hearing			398
Interferences heard			397
Interferences awaiting decision			15
Before the Board of Appeals:			
Appeals in ex parte cases		4,042	
Appeals in interference cases:			
Priorities	172		
Motions	185		
		357	
			4,399
Ex parte appeals decided		3,029	
Appeals in interference cases decided:			
Priorities	222		
Motions	215		
		437	
			3,466
Ex parte cases awaiting action		2,841	
Interference cases awaiting action:			
Priorities	89		
Motions	112		
		201	
			3,042
Oldest ex parte case awaiting action			April 19, 1939
Oldest interference case awaiting action			June 2, 1939
To the Commissioner:			
Appeals in trade-mark interferences	5		
Appeals in trade-mark oppositions	91		
Appeals in trade-mark cancellations	27		
Appeals in ex-parte trade-mark cases	37		
Interlocutory appeals	3		
		163	
Petitions to Commissioner:			
Ex parte	869		
Inter partes	195		
To make special	361		
To revive	494		
Under Rule 78	6,319		
		8,238	
			8,401
Cases disposed of by Commissioner:			
Appeals in trade-mark interferences	4		
Appeals in trade-mark oppositions	71		
Appeals in trade-mark cancellations	21		
Appeals in ex parte trade-marks	28		
Interlocutory appeals	3		
		127	
Petitions disposed of:			
Ex parte	869		
Inter partes	195		
To make special	361		
To revive	494		
Under Rule 78	6,319		
		8,238	
			8,365

Litigated cases—Continued

Notices of appeals to United States Court of Customs and Patent Appeals:		
In ex parte cases (including three trade-marks)	97	
In inter partes cases (patents)	52	
Ex parte design application	1	
In trade-mark oppositions	22	
In trade-mark cancellations	12	
		184
To the District Court of the United States for the District of Columbia (suits)		116

OTHER DETAILS OF BUSINESS FOR THE FISCAL YEAR

As to the volume of business, the Office received during the year 74,153 applications for patents, reissues, and designs; 14,321 trade-mark applications and 1,151 applications for renewal of trade-mark registrations; 2,689 label and print applications; 171,524 amendments to patent applications; 12,835 amendments to design applications; and 17,558 amendments to trade-mark, label, and print applications.

The number of letters constituting the miscellaneous correspondence received and indexed was 482,120. In addition, 45,184 letters were returned with information.

The number of printed copies of patents sold was 4,041,895; 1,233,204 copies of patents were shipped to foreign governments and 846,118 copies furnished public libraries. The total number of copies of patents furnished was 6,752,896, including those for Office use and the use of other departments.

The Office received for record 45,344 deeds of assignment.

The Drafting Division made 796 drawings for inventors and corrected 12,301 drawings on request of inventors; in addition, 7,493 drawings were corrected for which no charge was made; 129,860 sheets of drawings were inspected; and 15,060 letters answered.

Typewritten copies of 3,063,700 words were furnished at 10 cents a hundred words. The Office certified to 17,262 manuscript copies, and furnished 6,199 miscellaneous certified copies. The Office also furnished 535,033 photostat copies of manuscript pages, 39,476 photographic copies, and 318,485 photostat copies of publications and foreign patents, for sale; 15,247 photostat-manuscript pages, 73 certified manuscript copies, and 10,751 photostat copies for Government departments, without charge; 36,959 photostat and 20,275 photographic copies for use of the Patent Office; 13,741 photostat copies for sale through photoprint section, and 206 photostats for Office use; also 81,452 photostats for assignments, grants, and disclaimers for official use; in all, 1,011,874 photostat and 59,751 photographic copies.

BUREAU OF MARINE INSPECTION AND NAVIGATION

The organization of the Bureau of Marine Inspection and Navigation remained substantially unchanged during the year. In Washington it is composed of the Vessel Inspection Division, Law Enforcement and Review Division, Technical Division, Ship Personnel Division, and Administrative Division. The field service is composed of 7 supervising inspection districts, 48 boards of local inspectors, and 14 offices of shipping commissioner. In addition, the Bureau operates a small fleet of patrol vessels for the enforcement of the navigation laws, particularly the Motor Boat Act.

VESSEL INSPECTION DIVISION

This Division is responsible for the administration of the inspection laws, the safety and seaworthiness of all merchant vessels subject to its jurisdiction, and the administration and enforcement of rules and regulations governing construction, equipment, operation, and manning of such vessels. The administrative staff in Washington under an assistant director supervises and directs the activities of 48 boards of local inspectors situated in various ports within the continental United States and in the Territories of Puerto Rico, Hawaii, and Alaska, and through these boards establishes a uniform interpretation of these rules and regulations. The field inspection force comprised 96 local inspectors and 309 assistant inspectors on June 30, 1939, whereas the Washington staff consisted of 10 principal and 4 traveling inspectors, 1 nautical expert, and the clerical staff.

The United States is divided geographically into seven supervising inspection districts, each district being presided over by a supervising inspector. The supervising inspectors are authorized by statute to meet as a board once each year, and at such other times as the Secretary of Commerce shall prescribe, to promulgate, with the approval of the Secretary of Commerce, all necessary rules and regulations for the promotion of safety of life at sea.

The regulations adopted during the past few years, looking toward a higher safety factor in regard to damage from collision and fire, required modifications, and additional equipment was provided for in many cases. These changes were complied with to a large degree during this fiscal year; and, considering the requirements as applied to existing vessels, the Bureau was accorded remarkable cooperation from the industry. During the fiscal year the first passenger vessel constructed in accordance with the Bureau's latest safety requirements entered service. This vessel is the forerunner of a fleet of vessels which will be models in marine safety, they being virtually fireproof, and as unsinkable as the art can warrant. The advancement made with respect to passenger vessels also applies to the new cargo vessels and tankers constructed and placed in service during

the year. These vessels were constructed of fire-resistive material and equipped with modern machinery and safety equipment consistent with the best known marine practices for the services in which they will operate.

The Division has continued to lay great stress on the drilling and instruction of the crews of passenger ships to the end that they may be ready to cope with any emergency which might arise. This intensive drilling by local and assistant inspectors, with check-up inspections conducted by traveling inspectors, has had the effect of creating a more efficient working organization of masters, officers, and crews. It has been the endeavor of the Division to coordinate the program of maritime safety with the activities of the personnel on inspected vessels by training the officers and crews thoroughly in the handling of all types of emergency equipment. This training has raised the morale of all ships' personnel and has caused the crews to become "safety minded." The safety record of loss of but one passenger's life due to casualty during the past 4 years is largely attributable to the fact that masters, officers, and crews of American vessels have come to recognize that eternal vigilance on their part is the price of safety.

Notwithstanding the progress made, injuries to seamen as a result of falling from aloft, falling into cargo holds, slipping on ladders, entanglement in machinery and cargo gear, improper use of vessel equipment, etc., continue to occur. The causes of these casualties are being closely studied in order to reduce them to a minimum by the elimination of all hazardous conditions, insofar as is practicable, and by the issuance of instructions to the crew.

The problem of maintaining a measure of uniformity among 48 local boards and 405 inspectors requires constant supervision, and in this respect real progress has been in evidence throughout the year. Due to the energy and alertness of the inspectors, the standard of inspections has been appreciably raised.

The revision of the Ocean and Coastwise General Rules and Regulations went forward and a second draft was prepared that will be forwarded to the industry for comments the early part of the coming fiscal year. Several conferences were held during the fiscal year for the purpose of studying a draft of proposed regulations pertaining to the carriage of so-called dangerous cargo. A draft of a bill was forwarded to Congress during its closing days which, owing to adjournment, was not enacted.

The Board of Supervising Inspectors continued its policy of advising industry of all proposed regulations, and, where necessary, invited participation at public hearings. This procedure has been found to aid considerably in clarifying misunderstandings and it also speeds enforcement.

During the fiscal year there were two executive committee meetings of the Board of Supervising Inspectors, held primarily for the purpose of approving various lifesaving and fire-fighting equipment, of a type involving new and advanced principles and design.

TRAVELING AND PRINCIPAL TRAVELING INSPECTORS

During the fiscal year the traveling and principal traveling inspectors covered a total of 329,571 miles in the transaction of their official

duties, 174,219 of which were at sea. They inspected 434 passenger vessels, 104 of which were inspected at sea. They also inspected 141 tank ships, 254 tank barges, and 29 freight ships; conducted 94 special and miscellaneous inspections; and on 147 occasions served as members of B boards in the conduct of investigations and trials.

LOCAL INSPECTORS

The Bureau's staff of inspectors performed the work listed below:

Annual inspections	6,558
Reinspections	2,805
Drydock examinations	5,473
Tail-shaft examinations	1,188
Cargo vessels examined; permission given to carry persons in addition to crew	1,415
Special examinations	20,479
Marine boilers inspected (28 condemned for use)	13,184
Marine steel boiler plates tested (108 rejected)	4,677
Certificates of inspection—withdrawn, refused, revoked	300
Miscellaneous examinations	22,465
Inspections of Government-owned vessels	234
Inspection stationary boilers for Government	2,111
Trials and investigations completed	2,381
Certificates of service and efficiency issued (2,324 applications for such certificates rejected)	55,447
Deck officers licensed	1,753
Engineer officers licensed (374 applicants for deck and engineer licenses refused)	1,859
Motorboat operators licensed	12,354
Life preservers inspected at factories (496 rejected)	171,620
Lifeboats inspected at factories	452
Boat davits inspected at factories—sets	185
Ring buoys inspected at factories (36 rejected)	12,946

As a result of favorable reports of findings by various local inspectors, the Director issued 106 safety certificates under the terms of the International Convention for Safety of Life at Sea.

LAW ENFORCEMENT AND REVIEW DIVISION

This Division reviews reports of all trials and investigations held in connection with marine casualties resulting from acts of incompetency, inefficiency, or negligence on the part of licensed officers and certificated seamen employed on merchant vessels of the United States. It is required to review and pass on applications and petitions submitted to the Secretary of Commerce for relief from statutory penalties which have been incurred by owners, operators, masters of vessels, and other persons for violations of the navigation and steamboat-inspection laws. It is charged with the duty of administratively interpreting legislation, drafting new legislation, preparing reports on bills introduced in Congress which relate to or affect navigation problems, and preparing or revising regulations to make effective the navigation laws of the United States.

This Division, whose administrative head is an assistant director of the Bureau, directs and coordinates the navigation law enforcement work of the several collectors of customs of the United States, the vessels of the patrol fleet, the personnel employed thereon, and other officers authorized to enforce these laws.

During the past fiscal year appeals in connection with 13,880 violations dealing with division of crews and watches, hours of labor, certification of personnel, manning and citizenship requirements, inspection of vessels, documentation of vessels, application of coastwise laws to foreign vessels, etc., were considered by this Division for appropriate recommendations to be made to the Secretary of Commerce for the mitigation or remission of fines and penalties incurred.

One of the officers of this division served as a member of the interdepartmental committee appointed for the purpose of drafting joint regulations for the entrance and clearance of aircraft. These regulations are rapidly approaching completion and should be promulgated in the near future.

At the request of the Secretary of the Interior and the Governor of the Virgin Islands, a representative of this Division visited the Virgin Islands to make a study as to whether the application of tonnage duties, light money, and other navigation fees to vessels arriving at these islands would affect the economic life of the islands. A thorough and detailed report made by this representative received consideration by the appropriate Congressional committees, legislation subsequently being passed exempting the Virgin Islands from the application of these requirements.

At the request of the Attorney General of the United States, the assistant director in charge of this Division assisted in the preparation of the Government's brief in the case of the *United States* v. *12,536 Gross Tons of Whale Oil.* He also appeared on behalf of the Government at the trial of the issue in the United States District Court at Norfolk, Va., on February 9, 1939.

A booth was maintained at the New York Motorboat Show and representatives were in attendance to answer inquiries pertaining to the laws govering operation and equipment of motorboats and other vessels.

During the fiscal year 1939, the "A" Marine Investigation Boards were not once called into session to investigate any passenger loss of life resulting from casualties to inspected vessels coming within the jurisdiction of the Bureau. These Boards, however, were called into session a number of times to investigate loss of life resulting from accidents to members of the crew, at least 90 percent of which accidents were due to special hazards connected with seafaring life.

There was no noteworthy casualty recorded where the monetary damage was exceedingly large, and there was no total loss due to casualty to a seagoing vessel although there were several smaller vessels engaged in coastwise service and in service on the rivers and Great Lakes which were lost due to casualty.

None of the above losses was found to be due to neglect on the part of the Government officials connected with the inspection of vessels nor was there any case of gross negligence on the part of the licensed or certificated personnel. However, there were cases of negligence on the part of certain licensed personnel concerned with casualties and appropriate action in each case was taken by the Director.

The usual number of minor casualties occurred during the fiscal year of 1939, most of which resulted in small damage to the vessels concerned, and which had little or no effect on their carrying out the business in which they were engaged.

There were only two outstanding cases during the year of insubordination among the certificated personnel and these were dealt with promptly.

The total number of cases reported to the Bureau as having been investigated during the fiscal year 1939 is as follows:

Major "A" [1]	47
Minor "A" [2]	411
"B" cases	77
Complaint [3]	297
"C" cases	2,813
Total	3,645

[1] Loss of life to crew members due to casualty on inspected vessels.
[2] Single loss of life to crew members not due to casualty on inspected vessels and also loss of life on uninspected vessels.
[3] Any complaint with reference to misconduct, misbehavior, inattention to duty, or violation of the navigation laws by licensed or certificated personnel.

PASSENGER ACT

The Law Enforcement and Review Division is also responsible for administration of the Passenger Act of 1882, which contains certain provisions for the accommodations for steerage passengers. Vessels entering ports of the United States from foreign countries, having on board steerage passengers, are supervised by customs inspectors who see that these provisions are complied with. The purpose of the act is to look after the welfare, health conditions, food, separation of the sexes, and care in case of illness of passengers. There were 661 voyages made, involving 121,828 steerage passengers during the fiscal year 1939, as compared with 794 voyages involving 154,787 steerage passengers during the fiscal year 1938.

SHIP MORTGAGE ACT

The Ship Mortgage Act provides for the recording of all mortgages on vessels of the United States and the endorsement on the vessels' documents of all preferred mortgages. It is necessary that the owner of every vessel, prior to its documentation under the laws of the United States, and upon every change in ownership or change in home port, designate a home port for the vessel which must be approved by this Bureau before such designation may become effective. During the fiscal year 1939, there were approved 9,214 such home-port designations as compared with 7,956 approvals during the preceding year.

COLLECTION OF FEES AND DUTIES

This division, through the collectors of customs, supervises the collection of tonnage taxes and other navigation fees. It also considers petitions of ship owners and operators for refunds of tonnage taxes and navigation fees when they have allegedly been illegally or erroneously assessed. During the fiscal year the sums of $1,704,056.70 in tonnage duties and $207,015.88 in navigation fees were collected.

NUMBERING OF MOTORBOATS

On June 30, 1939, there were numbered 262,463 motorboats. This is an increase of 40,917 during the year. It must be borne in mind,

however, that this increase does not represent in its entirety new building, for the reason that for the past 3 years the motorboats of the United States were being renumbered, and in many outlying districts the renumbering process proceeds very slowly. During the year 5,456 motorboats were removed from the records, having been reported lost, abandoned, etc.

PATROL FLEET

The patrol fleet maintained by the Bureau consists of three vessels—*Siwash*, *Navigation*, and *Tyrer*—and two 18-foot launches. The three patrol vessels are operated throughout the year on the Atlantic and Gulf coasts. One of the two launches is assigned the district comprising the entire Mississippi River basin. The other is working in Pacific coast ports. The personnel of the vessels is engaged in the enforcement of the navigation laws, particularly the Motorboat Act, the Numbering Act, and the Tanker Act. These boats have been of material assistance to the local inspectors in enabling them and their assistants to reach a larger number of the vessels under their jurisdiction. Examination of tank vessels having on board inflammable or combustible liquids in bulk continues to occupy much of the time of the fleet.

Out of a total of 15,323 inspections made by the patrol fleet, 11,522 violations were reported, and in addition, other enforcement officers reported 10,000 violations.

LEGISLATION

The present Motorboat Act, approved June 9, 1910, and not since amended, is in many respects unsatisfactory. It imposes an undue burden on the owners of small boats and does not set forth the requirements which are necessary and proper for the safety of life and property on the larger boats. To correct this situation the Bureau made a very comprehensive study which resulted in the preparation of new legislation repealing the old act. Before submitting the proposed bill, the Bureau obtained the views of representatives of motorboat organizations, boat and engine manufacturers, owners and operators of commercial craft, and others concerned, and it is believed that the bill fairly expresses the consensus of opinion as to necessary legislation. The proposed bill submitted by the Bureau was transmitted to Congress on April 20, 1939, and was thereafter introduced in both Houses. This bill passed the House of Representatives, was reported out favorably by the Senate Committee on Commerce, and will no doubt be considered by the Senate at its next session.

The provisions of the navigation laws with respect to the transportation of dangerous, combustible, or inflammable cargo are conflicting and very unsatisfactory. The Vessel Inspection Division of this Bureau gave the matter of suggesting legislation, which would take care of this highly dangerous mode of transportation, long and careful consideration. At the conclusion of this exhaustive study, the Law Enforcement and Review Division collaborated with the Vessel Inspection Division in the preparation of a tentative draft of proposed legislation which would amend section 4472 of the Re-

vised Statutes and repeal any existing legislation in conflict therewith. This proposed legislation was transmitted to Congress by the Secretary of Commerce and thereafter introduced.

The Law Enforcement and Review Division was requested to prepare proposed enabling legislation to make effective the provisions of International Labor Conference Treaty, Draft Convention No. 53, and to assist other governmental departments and agencies to prepare enabling legislation to make effective Draft Conventions Nos. 55 and 58, which were ratified by the United States in 1938. The proposed legislation to make effective provisions of Draft Convention 53 was enacted and became the act of July 7, 1939, Public, No. 188. It is hoped that the other bills will receive favorable consideration at the next session of Congress.

The gambling barges anchored off the coast of southern California have for several years presented a menace to public safety and public morals. During the fiscal year, this Division collaborated with the Department of Justice and the Treasury Department in preparing tentative legislation to eliminate the operation of these vessels.

This Division was also requested by the Department to review and submit individual reports on 90 bills and resolutions. In addition, it prepared drafts of 12 separate bills which were to amend and clarify the navigation laws of the United States, and 11 of these tentative drafts were submitted to Congress through the Secretary of Commerce. Of the 11 bills prepared and submitted, 7 were passed by the first session of the Seventy-sixth Congress and signed by the President. Of the 7 bills passed, 6 were remedial in nature and served either to clarify ambiguities which heretofore had existed in the navigation laws or to remove obsolete requirements therefrom.

TECHNICAL DIVISION

The primary function of this Division is to examine and pass on all contract plans and specifications for the construction of new or major alterations to existing passenger vessels of the United States of 100 gross tons and over propelled by machinery. If the plans and specifications are approved by the Director, the construction or alteration of the vessel may begin.

The Technical Division also passes on plans and specifications for the construction of new vessels and alterations to existing types of vessels, regardless of whether they are engaged in passenger or other services. Since these vessels must comply with the Bureau's safety requirements before a certificate of inspection will be issued, it is also necessary that their plans and specifications be approved to insure a uniform standard of safety and to avoid additional construction costs and unnecessary delays in sailings.

The Division is comprised of the naval architecture subdivision (hull and admeasurement sections); the marine engineering subdivision; the electrical engineering subdivision; and the load-line subdivision.

NAVAL ARCHITECTURE SUBDIVISION

Hull section.—This section examines and recommends the approval or disapproval of structural and arrangement plans and specifications

for the construction or alteration of all vessels under the jurisdiction of the Bureau. The constructional characteristics, types, and designs of fire-detecting and extinguishing equipment, damage control apparatus, lifesaving equipment, etc., for use on inspected vessels are also considered by the section, and reports recommending approval or rejection prepared for consideration by the Board of Supervising Inspectors. The work also included stability tests and investigations into stability of vessels in damaged condition, the answering of technical inquiries, the preparation of proposed rules and regulations, and extensive experimental work to determine the suitability of various materials for use in the construction of new fire-resisting vessels.

During the fiscal year 1939, plans and specifications for 132 new designs, representing 168 new vessels, were examined as compared with 114 new designs and 136 new vessels in 1938. In each case plans for the arrangement of the passenger and crew accommodations, the adequacy of means of escape, the type and arrangement of ventilating facilities, the number, size, and type of lifeboats and other lifesaving equipment and arrangements of means for launching them, the strength of structural members, the type and capacity of fire-control arrangements and equipment, the watertight integrity of the vessel, and stability characteristics were verified and checked to determine compliance with present laws and regulations.

In addition to the new designs enumerated above, plans for 105 new barge designs covering approximately 160 barges, as compared with 230 barges in 1938, were checked to establish their strength and compliance with Bureau rules.

Plans for the alteration or conversion of 340 vessels were received, as compared with 270 in 1938, and appropriate action was taken and investigations of subdivision and damaged stability of existing passenger vessels were continued. Subdivision load lines were assigned to 51 vessels.

Subdivision and stability requirements that would insure that ferry vessels on runs of more than 10 minutes remain afloat with positive stability in the event that any one compartment was accidentally flooded became effective January 1, 1939. Pursuant to the imposition of this requirement upon vessels of this class, flooding and stability calculations were made for 150 vessels operating in this service. Where vessels were found to be deficient, corrective measures, usually additional watertight bulkheads, were required. Similar requirements became effective April 15, 1939, for river passenger vessels of more than 75 gross tons. Investigations of 100 vessels of this class were conducted to insure conformance with these requirements. In both cases, the necessary calculations and other details incident thereto were made by this section and transmitted to the owners via the local inspectors. Necessary follow-up was maintained with the local inspectors until compliance with specified requirements was reported.

Inclining tests on 96 vessels were conducted at various ports in the United States by members of the section and calculations were made in each case to determine their stability. When plans were not available, the vessels were measured in drydock and plans drawn from which calculations could be made. In instances of insufficient stability, installation of ballast or other corrective measures were re-

quired. In a number of cases, calculations were made to determine the effect of alterations on stability of existing vessels, and appropriate action was taken to insure the proper margin of safety.

Special inspections were held by members of the Hull Section on 31 vessels to determine the practicability of applying specific requirements. These inspections covered construction surveys, lifeboat lowering device arrangements, fire-detecting and fire-extinguishing systems, and the operating characteristics of vessels at sea.

During the year a series of tests of fire-resisting bulkhead materials were conducted in conjunction with the National Bureau of Standards. These tests were for the purpose of determining the suitability of fire-retarding materials that could be used in the construction of type A–1 bulkheads and for panels to be used in the construction of type B bulkheads. Tests were also conducted on various types of deck covering to determine fire-retardent characteristics and suitability for application to decks in relation to the space in which it is proposed to use such covering. As a result of these tests the materials of a number of manufacturers have been approved for marine use. These materials have been used in the construction of the three new Panama Line vessels and numerous Maritime Commission vessels and will be used, in locations approved by this section, on all new vessels including the S. S. *America* and those of the Mississippi Shipping Co. now under construction.

Admeasurement section.—During the fiscal year 1939, there were 1,612 new vessels aggregating 434,680 gross tons admeasured for documentation as compared with 1,883 vessels, aggregating 463,064 gross tons, in 1938. In the case of new construction all plans necessary to the admeasurement of a vessel are required to be checked, whereas in the case of structural alterations and rearrangements of space in existing vessels, only those plans affected by the change are checked. The plans of 218 new vessels, aggregating 205,304 gross tons, were checked by this section during the fiscal year for original documentation. Due to structural alterations, changes in usage of spaces, etc., admeasurement figures on 443 existing vessels, aggregating 705,234 gross tons, were also checked for redocumentation. Under the act of February 28, 1865, passenger cabins and staterooms located on a deck not a deck to the hull are not required to be included in tonnage, but are not so treated under the laws of foreign nations into whose ports such vessels enter. Accordingly, for use in foreign ports, a special appendix to Certificates of Registry was issued to 37 American passenger vessels showing gross and net tonnages adjusted after inclusion therein of such passenger accommodations.

In addition to an American document, other documents may also be required necessitating adjustments of tonnages to comply with the measurement laws for the Panama Canal and Suez Canal. Sixty-eight vessels, aggregating 626,284 gross tons, were furnished Panama Canal tonnage certificates and 20 vessels aggregating 179,209 gross tons, were issued Suez Canal special tonnage certificates.

Circular letters were issued to collectors of customs and others instructing them in new procedures to be followed in making allowances for additional deductions from gross tonnage; special deduction of captain's bridge; treatment of skylights, hoods, stairways, elevators, and various other spaces, with drawings for Suez Canal

special tonnage certificates. For United States documentation, circular letters were issued defining an open structure on small craft; cabins and staterooms for passengers; and treatment of portable fresh-water tanks.

The 1925 Measurement of Vessels regulations were revised during the year to bring them more in line with present-day requirements, to eliminate impracticable methods of admeasurements, to provide more liberal deductions, etc. It is hoped to have these regulations in the hands of the printer in the near future.

While the Director of the Bureau of Marine Inspection and Navigation is charged with the supervision of the admeasurement laws, the field work is performed by some 126 employees of the Treasury Department.

MARINE ENGINEERING SUBDIVISION

During the fiscal year ended June 30, 1939, this subdivision completed several important investigations concerning steel boiler plates and high-pressure piping. As a result of these investigations a thorough revision of the piping rules, together with new specifications for marine boiler plate, and a table covering adjusted pressures for alloy-steel materials were prepared and submitted to the Board of Supervising Inspectors for appropriate action. New processes of welding alloy and clad materials were also investigated to determine their suitability for use in the marine field and resolutions concerning them were submitted to the board for consideration.

Investigations were conducted relative to tests to determine the capacity of safety valves. These tests were necessitated by the fact that it is now common practice to expose superheaters to the radiant heat of the fire and in view of this accumulation tests formerly required to determine the capacity of safety valves are now impracticable in some instances. The findings thus far indicate that a revision of the rules concerning safety valves will be necessary.

The duties of this subdivision also included examination of plans submitted by shipowners and builders, for approval or disapproval, covering machinery arrangements, piping systems, Diesel installations, refrigerating installations, fire mains, arrangements of sounding tubes, vents and overflows, steaming-out and steam-smothering systems, sea chests, pressure vessels, including passenger and freight vessels, barges, oil tankers, and towboats. In addition, plans and specifications were examined and passed upon for alterations, repairs, conversions, or reconstruction of boilers, machinery, arrangement, piping systems, and equipment, etc., for 265 vessels, and for 53 boiler installations for other Government agencies; fuel-oil installation plans were approved for 35 vessels; welding rods and electrodes were tested for approval and those conforming with the Bureau's rules were accepted; 264 welding operators were tested and qualified; and radiographs of 203 welded boilers; pressure vessels and high-pressure air tanks were examined.

The various investigations conducted, conferences attended with representative of shipbuilders, the Navy Department, other safety organizations and societies, and discussions entered into were for the purpose of keeping the Bureau in step with new developments and changes in the marine field, particularly those applying to the pro-

pulsion plants and auxiliary machinery of merchant ships. During the past year the tendency has been to increase the pressure and total temperature of steam generated on new vessels under construction. With such increases, new problems arise, such as finding suitable materials for boiler tubes, valves, fittings, and piping to withstand these higher pressures and temperatures.

ELECTRICAL ENGINEERING SUBDIVISION

The duties of this subdivision include the examination of plans and specifications submitted to the Director for approval in connection with lighting and power-distribution circuits, emergency lighting and power-distribution circuits, interior-communication circuits (including types of electrical fittings and fixtures and other apparatus comprising the electrical systems proposed for use on all types of merchant vessels). Plans showing the type and construction of generators and motors, control equipment for generators and motors, switchboards and distribution panels, circuit protective devices, communication apparatus, and types and capacities of electric cable are also included.

Many types of electrical equipment, such as fire-detecting and alarm systems, emergency lighting and power-control systems, searchlights, lighting fixtures, wiring appliances, etc., were tested during the year and given type approval for use on vessels under construction.

Specifications and instructions were prepared for the use of local and assistant inspectors in inspecting electrical systems and apparatus aboard ship. The most important specification completed during the year covered the construction, colorimetric properties, and approval procedure for navigation lights required on all vessels over 65 feet in length. Instruction booklets completed during the year cover the inspection, operation, and maintenance of approved fire-detecting systems and the use, location, and type of all navigation lights required by the navigation laws of the United States.

The electrical plans and specifications covering the construction of the following new vessels have been checked by this subdivision: 12 passenger vessels, 24 cargo vessels, 14 tank vessels, and 25 miscellaneous vessels, a total of 75 vessels of all classes as compared with 61 vessels during the fiscal year 1938. Electrical plans of major alterations to 9 vessels and plans covering installation of emergency lighting systems and emergency loudspeaker systems on approximately 100 vessels have also been checked.

Samples representing a great variety of electrical equipment suitable for marine use were examined and approved. This equipment includes watertight and vaporproof lighting fixtures, connection boxes and wiring appliances, berth lights, bells and other signaling devices, switches, and control units, as well as explosion-proof electrical equipment suitable for use in hazardous locations.

The electrical engineering subdivision has continued to prepare specifications and minimum standards for many items of marine electrical equipment. This work is being done in cooperation with the National Bureau of Standards, the American Institute of Electrical Engineers, and manufacturers of such equipment.

LOAD LINE SUBDIVISION

On the recommendation of this subdivision, the Load Line Act of March 2, 1929, applicable to vessels in the foreign trade, was amended on May 26, 1939, lowering the tonnage limit from 250 gross tons to 150 gross tons, exempting from the provisions of the act all merchant vessels that are being towed when carrying neither cargo nor passengers, and authorizing the remission or mitigation by the Secretary of Commerce of the penalty for overloading a vessel.

During the fiscal year amendments to section D of the Load Line Regulations were prepared, approved by the Secretary of Commerce, and became effective on October 20, 1938, requiring the bulkhead deck of all subject vessels to be designated on the load line certificate and requiring cargo ports to be closed at sea only when fitted below the bulkhead deck. Copies were distributed to the countries signatory to the International Conference on Safety of Life at Sea.

Special consideration was given a method for determining the position of the load line for sandsuckers operating on the Great Lakes. In order that the procedure in Canada for locating load lines on Canadian sandsuckers and that followed in the United States would be on the same basis, a representative of this Bureau went to Canada to confer with officials on this subject. As a result of this conference an agreement was reached whereby the two governments will determine the positions of load lines on these types of vessels on the same computations. Conferences were also held with the American Bureau of Shipping regarding the assignment of load lines to sandsuckers and load lines for 30 such vessels were determined during the year.

Information was obtained from experienced collier masters, and others, regarding the comparative merits of opened or closed bulwarks on steam colliers, without a preponderance of opinion either way. To obtain actual experience in service, a steam collier was fitted with a reduction of freeing port area, as an experiment, the efficacy of which has not been determined.

Personal instructions were given to collectors of customs, their deputies, and the Coast Guard, where needed, in regard to their duties in connection with reports of sailings of vessels, inspection of load lines of vessels, and reports of violations of the load line laws.

Four countries acceded to the International Load Line Convention during the last fiscal year, and circular letters were promulgated to that effect.

During the fiscal year load line certificates were issued to 228 vessels, and 45 certificates were voided for various reasons. Revalidations of existing load line certificates were 426. Load line certificates were issued for 4 foreign vessels and revalidations of existing certificates were effected for 15 foreign vessels. Annual load line inspections were accomplished for 2,098 vessels. Reports of sailings of 20,607 vessels were received and checked for compliance with the regulations. There were 79 violations of the load line acts reported and appropriate action was taken.

Applications for special service load lines, as provided by section B of the regulations, were approved for 43 vessels and 2 such applica-

tions were disapproved. In this connection a special investigation was made that determined that voyages between Southport, N. C., and Savannah, Ga., could not be approved as special-service voyages.

SHIP PERSONNEL DIVISION

This Division supervises the field activities of 14 United States shipping commissioners, located in as many ports throughout the United States. Shipping commissioners are required by law to witness the shipment and discharge of crews on shipping articles of agreement for all vessels in foreign and intercoastal trade. They act as arbitrators for masters and seamen in settling controversial matters, such as wages, working conditions, overtime, etc.

The following documents have been issued to seamen by appropriate field officers during the fiscal year and copies forwarded to the Central Records Section: 23,455 continuous discharge books; 33,401 certificates of identification; 4,289 able seamen's certificates; 4,959 lifeboat certificates; 4,955 certifications as a qualified member of the engine department; 40,511 certificates of service; 733 tankerman certificates; a total of 112,303 certificates of all classes, including continuous discharge books. There were 7,077 duplicate continuous discharge books and certificates of various kinds prepared by this Division for issuance to seamen who lost their original papers. Under the law the seamen are required to pay a fee for duplicate documents when originals have been lost other than by shipwreck or other casualty. The details of recording in each seaman's jacket pertinent information from the 112,303 certificates received this year, the filing of these records, the answering of correspondence and other inquiries in connection therewith have been difficult to administer because of insufficient personnel. The 25 junior clerk-typists available for this work are inadequate to keep the volume of work handled by the Central Records Section current. To maintain accurate records regarding the sea service, training, and experience possessed by vessel personnel and to make these records readily available as a source of information in connection with employment, investigations of casualties, acts of misconduct, negligence, etc., additional personnel is essential.

LICENSED OFFICER EXAMINATION SECTION

The Examination Section continued its efforts with respect to the establishment and formulation of a procedure which has for its purpose the standardization and centralization of the Bureau's method of conducting examinations for licensed officers. A number of examinations for licensed officers have been prepared, sufficient to inaugurate a system of standardized ocean and coastwise examinations, and a codified system of question files is nearing completion which will ensure a constant changing of the examination questions and papers and safeguard the confidential nature of the transactions.

In the Bureau's 48 examination centers, it has been the duty of the examiners of masters, mates, and engineers to test each candidate's knowledge in a written examination, and to determine his fitness to hold the license sought. While the Bureau strives for uniformity, it has been obvious that it could not be attained without centralization.

It was not until recent years that the funds necessary to begin the work of centralization and the revision of examinations were made available to the Bureau. During the past year intensive research and preparation has been undertaken at the Bureau to effect a complete revision of the rules governing the experience, qualifications, and examinations of licensed officers. Experience requirements have been made considerably more exacting and inconsistencies removed. Hitherto complaints have frequently been made to the effect that set books were not recommended or a clear indication given as to what course of study was necessary to fit a man for his tests. Specimen examinations have been drawn up which will be published in the next issue of the Rules and Regulations and will serve as a guide to all those who are studying for the examinations. Since many of our officers study at sea and not at schools, this will be of great assistance to them.

When preparations are completed, it is proposed to have sets of examination papers, compiled at the Bureau in Washington, sent to the 48 field officers under seal. These seals will not be broken until the candidates are assembled for examination. New and drastic rules have been drawn up and will be enforced for the conduct of these examinations. Every effort will be made to have these examinations conducted on the best possible lines so that they will give the candidates a fair and equal opportunity, with favor to none. Under this new system the examinations on any day at any port in the United States and its possessions will be identical.

The new rules and regulations relating to licensed officers were sent to the field force for comments, and many valuable suggestions were received and incorporated.

The Bureau inaugurated a system of sea observations, with shipmasters as official observers, sending in, regularly, selected celestial observations in accordance with instructions issued by the Bureau, and this continues to operate smoothly, with 75 shipmasters as official observers and a waiting list of 100. The best of these observers were honored by a letter of commendation from the Secretary of Commerce on November 28, 1938. The work of these men is carefully noted by the staff at Washington and much credit is due to these masters and officers for the time and trouble they take to make accurate and unusual observations in the interest of progress.

During the fiscal year, 6,662 deck officers' licenses, 8,168 engineer officers' licenses, and 12,354 licenses to motorboat operators were issued.

AMERICAN SHIPPING ON JUNE 30, 1939

On June 30, 1939, the merchant marine of the United States, including all kinds of documented craft, comprised 27,470 vessels of 14,631,991 gross tons, as compared with 27,309 vessels of 14,676,382 gross tons on June 30, 1938. Of this total, 1,513 vessels of 3,332,661 gross tons were engaged in the foreign trade, as compared with 1,825 vessels of 3,591,521 gross tons on June 30, 1938, and 25,957 vessels of 11,299,330 gross tons were engaged in the coasting trade.

Geographically, there were 16,816 vessels of 10,197,150 gross tons operating on the Atlantic and Gulf coasts; 6,868 vessels of 2,471,239 gross tons on the Pacific coast; 2,108 vessels of 1,711,965 gross tons

on northern lakes; and 1,678 vessels of 251,637 gross tons on western rivers.

The five principal services, from the standpoint of number of vessels engaged therein, were: Freight, 9,771 vessels of 8,614,533 gross tons; fishing, 6,674 vessels of 241,912 gross tons; passenger, 3,725 vessels of 1,722,853 gross tons; towing, 3,527 vessels of 344,850 gross tons; and tank, 1,092 vessels of 3,088,671 gross tons.

The following is an analysis of the ownership of documented tonnage (5 net tons and over): Private ownership, 27,334 vessels of 13,774,958 gross tons; Maritime Commission, 136 vessels of 857,033 gross tons.

LAID-UP VESSELS

On June 30, 1939, the laid-up tonnage of the United States aggregated 1,604 vessels of 2,252,396 gross tons, as against 1,890 vessels of 2,967,672 gross tons on June 30, 1938.

Details of the world's laid-up tonnage and classification of American vessels by size, service, and power may be found in Merchant Marine Statistics, 1939.

APPROPRIATIONS

The following appropriations were made available to this Bureau for the fiscal year 1939:

Departmental salaries	$336,760
Salaries and general expenses	2,322,000
Total	2,658,760

The amount appropriated for the Bureau's activities is largely offset by the tonnage taxes, fees, fines, and penalties collected during the same period. These amounted to $2,069,612.35.

COAST AND GEODETIC SURVEY

The Coast and Geodetic Survey carries on extensive surveying operations in all coastal waters of the United States and its possessions and produces the charts required for the safe navigation of coastal and intracoastal waters; compiles aeronautical charts to meet the needs of the pilots of aircraft; makes seismological studies for use in designing structures to reduce the earthquake hazard; determines geographical positions and elevations along the coasts and throughout the interior in order to provide a basic framework for mapping and other engineering work; studies tides and currents and establishes datum planes for engineers and tide-and-current predictions for mariners; observes the earth's magnetism in all parts of the country for information essential to the mariner, aviator, land surveyor, radio engineer, and others; and makes gravitational and astronomical observations and obtains fundamental data for geodetic surveys and scientific investigations of the earth's crust.

Besides the Washington main office, there are field stations located at Boston, New York, New Orleans, San Francisco, Seattle, Honolulu, T. H., and Manila, P. I.; observatories at Gaithersburg and Cheltenham, Md., San Juan, P. R., Tucson, Ariz., Ukiah, Calif., Sitka, Alaska, and Honolulu, T. H.; numerous primary tide stations along our coasts; and a number of stations maintained for various purposes by the Survey in cooperation with other Federal and private agencies.

To the maritime public and to official maritime services, there was an increase in issue of navigational publications of 10.8 percent over 1938. This was 183 percent as compared with the issue of such publications a decade ago. The distribution of nautical charts continued in heavy volume only slightly less than the record distribution of last year. The extension of aerial facilities and the growing desire for knowledge of aerial navigation and the proper use of aeronautical charts was responsible for an increase in the distribution of such charts amounting to 22½ percent over the previous year. These figures are especially remarkable in light of the knowledge that the 1938 issue of both nautical and aeronautical charts was an all-time record.

The annual issue of aeronautical charts was 366,353, exceeding all previous years in the history of the Bureau, while the annual issue of nautical charts was 350,062.

The activities of the Bureau continued to be affected by the increased activities of other agencies. The Lighthouse Service continued actively the construction and installation of new and better aids to navigation. Extensive work was accomplished by the U. S. Engineers in dredging and improving waterways. Especially active

was the Civil Aeronautics Authority in marking new air routes and re-marking old ones. Almost all the radio ranges in the country were improved or realigned to an extent which rendered our previous charts obsolete. While all these improvements are exceedingly beneficial to the marine and aviation industries, they do add materially to Bureau work in the revision of its charts and necessitate frequent issues of new editions.

The Bureau had a personnel of 1,125 on duty at the close of June 30, 1939—353 (17 commissioned and 336 civilian) on duty in the Washington office and 772 (159 commissioned and 613 civilian) in the field service. The field personnel included 417 seamen and 127 hands, of which number 51 civilians on duty at the Manila office and 50 members of the crew of the ship *Fathomer* were under the jurisdiction of this Bureau but were paid by the Philippine Government.

Acquisitions by the library and archives included 316 hydrographic and 130 topographic sheets, representing new Bureau surveys; 1,182 blueprints (mostly surveys by Army Engineers); 2,563 maps; 1,073 charts; 9,595 field, office, and observatory records; 493 negatives; 1,365 prints; 275 lantern slides; 3,500 books; and 4,371 periodicals.

Collections covering miscellaneous receipts, including nautical and aeronautical charts and publications, totaled $109,950.44, as compared with $109,871.32 during the preceding year.

The regular appropriations for 1938 were $2,665,550. These were supplemented by additional funds, making a total available for obligation of $4,803,600. The supplemental funds were as follows: Transfer from salaries and expenses, Soil Conservation Service (transfer to Commerce) 1939, $35,500; working fund (War: Flood Control, Mississippi River and Tributaries), $18,000; working fund (Navy: Maintenance, Yards and Docks) 1939, $4,600; working fund (War: Rivers and Harbors), $6,000; Public Works Administration, act of 1938 (allotment to Commerce, Coast and Geodetic Survey) 1938–40, $2,051,000; and an allotment from the Department of Commerce for travel of $22,950.

Actual disbursements during the year ended June 30, 1939, totaled $3,517,283.83, distributed among the various appropriations as follows:

Party expenses, 1937	$197.30
Pay, etc., officers and men, vessels, 1937	87.57
General expenses, 1937	.75
Field expenses, 1938	94,785.29
Repairs of vessels, 1938	6,705.71
Pay, etc., officers and men, vessels, 1938	122,872.40
Pay and allowances, commissioned officers, 1938	88,087.59
General expenses, 1938	5,478.23
Aeronautical charts, 1938	9,328.89
Salaries and expenses, Soil Conservation Service (transfer to Commerce, Coast and Geodetic Survey, act of Apr. 27, 1935), 1938	17,566.62
Traveling expenses, Department of Commerce, 1938	8,442.43
Working fund, Commerce, Coast and Geodetic Survey (Navy: Maintenance, Yards and Docks), 1938	1,200.00
Salaries, 1939	579,869.88
Repairs of vessels, 1939	56,464.68
Pay of officers and men, vessels, 1939	420,558.52
Pay and allowances, commissioned officers, 1939	679,820.87
Aeronautical charts, 1939	95,928.86
Coastal surveys, 1939	198,338.86
Research, tides, currents, etc., 1939	11,365.80
Coast Pilot, 1939	3,909.38
Magnetic and seismological work, 1939	54,108.23

Federal, boundary, and State surveys, 1939	$69,985.11
Miscellaneous objects, 1939	3,498.96
Office expenses, 1939	59,198.39
Public Works Administration, act of 1938 (allotment to Commerce, Coast and Geodetic Survey), 1938–40	848,973.60
Traveling expenses, Department of Commerce, 1939	17,688.52
Working fund, Commerce, Coast and Geodetic Survey (Navy: Maintenance, Yards and Docks), 1939	4,593.55
Salaries and expenses, Soil Conservation Service (transfer to Commerce, Coast and Geodetic Survey, act of Apr. 27, 1935), 1939	34,588.98
Working fund, Commerce, Coast and Geodetic Survey (War: Flood Control, Mississippi River and Tributaries)	23,638.86
Total	3,517,283.83

CHART PRODUCTION

There were issued during the year 81 new editions of 77 different charts, and 420 new prints of 361 different charts. In addition to the revised editions and to meet the new requirements of marine commerce in places where new and detailed surveys have been made recently, the 7 new nautical charts listed below were issued during the year:

TEXAS.—No. 593. Freeport Harbor.
SOUTH CAROLINA.—No. 787. Winyah Bay.
FLORIDA.—No. 1264. Choctawhatchee Bay.
LOUISIANA.—No. 1274. Timbalier and Terrebonne Bays.
LOUISIANA.—No. 1276. Point au Fer to Marsh Island.
PHILIPPINE ISLANDS.—No. 4228. Digollorin Point to Cape Engano.
CALIFORNIA.—No. 5101A. San Diego to Santa Rosa Island.

The total number of charts on issue at the year's end was 794, of which 163 were compiled and printed at Manila. At the end of the fiscal year the Division of Charts was compiling 5 new charts and recompiling 5 old charts; engraving 7 new charts and reengraving 5 old charts; and reproducing by lithography 6 new charts.

An outstanding accomplishment of the year was the issue of nautical chart 5101A. This chart is an innovation, being the first of its kind to be especially prepared and issued for the use of commercial and naval vessels equipped with echo-sounding devices. It contains comparatively few numerical depths, the conformation of the bottom over the entire area covered being given by depth curves at 50-fathom intervals. The result is to bring out the steep slopes and broad plateaus of the bottom topography, with its submerged valleys and mountain ranges, as clearly as a well contoured map of land area shows similar features ashore.

The increase in the demand for aeronautical charts by civil and military aviation has paralleled the continued unprecedented growth of the aviation industry. This can be expected to accelerate during the next few years rather than stabilize, because of the expanded programs of the military forces and the Civil Aeronautics Authority. In order to maintain the accuracy of the aeronautical charts where the establishment of new airways and the construction of new airports and new facilities have made important changes, there were printed 106 new editions of 79 different charts and 64 new prints of 44 different charts.

In addition to the revised editions, there were prepared and issued during the year the following five new aeronautical charts:

KENAI. Alaska. Kenai Peninsula and vicinity.
6M. Regional. Northeast of San Francisco.
8M. Regional. Northwest of St. Louis.
21DF. Direction Finding. Northwest portion of United States.
22DF. Direction Finding. North Central portion of United States.

At the close of the year there were available 98 aeronautical charts of the United States and Alaska and 3 airway maps of the Philippine Islands. These include the entire series of 87 sectional aeronautical charts of the United States, 6 regional charts, and 4 direction-finding charts of the same area, and 1 chart of Alaska. In progress are 8 regional and 2 direction-finding charts, 1 chart of Alaska, and 1 special aeronautical chart of the metropolitan New York area.

During the year the Secretary approved the appointment of recognized dealers for the distribution of aeronautical charts. Fifty of these have been appointed at the major airports.

The manual Practical Air Navigation has continued to increase in popularity. The second edition, mentioned in the annual report for 1938, was exhausted within a few months. Of a reprint of 10,000 copies, delivered during the latter half of March, only 1,700 remained at the end of the year. A third and revised edition now in preparation will be used by the Civil Aeronautics Authority in an extensive pilot-training program.

The demands on the Division can be best illustrated by the fact that the number of printing-press impressions during the fiscal year totaled 8,105,105. This is in comparison with 7,099,304 for the preceding year and vastly exceeds any other year in the Bureau's history. As recently as 5 years ago, the number of press impressions was approximately 2,000,000. The steady and substantial growth in the demand for nautical and aeronautical charts and related publications is shown in the following table containing the statistics for these publications for the past 4 years.

Item	1939	1938	1937	1936
Nautical charts	350,062	351,150	333,366	275,800
Aeronautical charts	366,353	299,094	277,878	178,973
Strip maps				12,186
Air planimetric maps	5,450	6,705	4,544	4,236
Miscellaneous	4,747	3,241	3,166	2,857
U. S. Coast Pilots	7,441	10,842	8,062	6,167
Intracoastal Waterway Pilots	869	1,008	1,463	1,022
Distances Between United States Ports	931	529	559	429
Tide Tables	25,519	24,299	24,567	24,184
Current Tables	10,678	9,769	9,114	9,002
Tidal Current Charts	2,104	1,631	1,628	1,607
Practical Air Navigation	14,507	3,798	1,837	5,167
Total	788,661	712,066	666,184	521,630

HYDROGRAPHY AND TOPOGRAPHY

On the Atlantic coast the survey vessels *Oceanographer* and *Lydonia* continued work on the offshore hydrographic project extending from the New Jersey coast to *Nantucket Lightship*. The special wire-drag investigations of wrecks and critical soundings along the Atlantic coast from Cape Henry to Sandy Hook was continued under the supervision of the commanding officer of the ship

Oceanographer. The launches *Marindin* and *Rodgers* were used on this project.

The *Gilbert* continued work on surveys along the south coast of Cape Cod. During the late winter and early spring this vessel was engaged on special surveys for Navy anchorages in the Hudson River.

The *Mikawe* in the summer of 1938 completed the upper Chesapeake Bay hydrographic project and during the winter of 1939 completed the St. Johns River, Fla., hydrographic project. In the spring of 1939 the *Mikawe* began inshore surveys along the south coast of Cape Cod.

Schemes of second-order coordinating triangulation were extended up the James River, from Newport News to the vicinity of Hopewell, Va., and along the eastern shore of Chesapeake Bay, in the vicinity of Kent Island and the lower Chester River. A similar scheme was begun on the northern shore of Long Island, extending eastward from Oyster Bay.

A shore party at Key West, Fla., completed the new basic surveys of the Florida coast as far west as Key West Harbor. In June 1939 this party shifted operations to Choctawhatchee Bay, Fla. The new project consists of a survey of the eastern half of the bay and of the Intracoastal Waterway between Fort Washington and West Bay.

Small air-photographic compilation units were continued at Baltimore, Md., and Palatka, Fla. Experience with air-photographic surveys in advance of inshore hydrography has proved so timesaving and otherwise efficient that this procedure is being used whenever conditions permit.

In the Gulf of Mexico the ship *Hydrographer*, with the tender *Faris* operating as a subparty, continued hydrographic surveys along the Texas coast.

On the Pacific coast the ship *Guide* in 1938 engaged in surveys of the northern California coast. A wire-drag party also continued surveys along this coast.

In the spring of 1939 the *Explorer* started a project of revision surveys of tributaries to the northern part of Puget Sound in the vicinity of Anacortes and Bellingham, Wash.

The project of revision surveys of the Columbia River from its mouth to Vancouver, Wash., begun in 1935, was completed and a scheme of second-order triangulation was extended eastward to The Dalles, Oreg. An arc of second-order triangulation was begun along the Washington coast from the mouth of the Columbia River to Grays Harbor. A revision survey of Willapa Bay, Wash., was in progress at the end of the year.

In southeastern Alaska in 1938, the *Explorer* completed a new survey of Sitka Harbor and immediate approaches, including the wire-dragging of the principal channels in this area and then continued work on the new surveys in Sumner Strait and tributary arms. On account of her age, the *Explorer* was withdrawn from Alaskan surveys at the end of the 1938 season. The *Westdahl* continued work on original hydrographic surveys in Glacier Bay.

In southwestern Alaska the *Surveyor*, assisted by the tender *Wildcat*, extended surveys along the coasts of Unalaska and Umnak Island and in cooperation with the *Pioneer* extended advance triangulation

control as far westward as the Islands of Four Mountains. The *Pioneer* accomplished offshore hydrography in the vicinity of the Islands of Four Mountains and conducted astronomic, gravimetric, and magnetic observations at Dutch Harbor and Nazan Bay. The *Discoverer*, assisted by the tender *Helianthus*, continued surveying operations along the south coast of Unimak Island and the Alaska Peninsula. The *Guide* joined the Alaskan fleet in the spring of 1939 and began original surveys along the north coast of Unimak Island, extending from Cape Saricheff northeastward along the Alaska Peninsula, toward Bristol Bay.

In the Philippine Islands the *Pathfinder* continued original surveys along the west coast of Palawan, revision surveys in Verde Island Pass, and supplemental surveys along the west coast of Luzon.

The field stations of the Bureau in the United States, Honolulu, and Manila continued to render invaluable service in supplying information for the correction of charts in their vicinities and in disseminating nautical and engineering data in response to requests from local public and official sources.

Under an allotment of $1,425,000 from Public Works Administration funds, contracts were awarded for the construction of one main and one auxiliary survey vessel. These two modern units will be completed early in 1940 and assigned to surveys in the Aleutian Islands.

The 13 United States Coast Pilot volumes contain a wide variety of important information supplemental to that shown on the chart, such as a detailed description of the coast and information concerning the waterways, as well as maritime data for the ports of the United States and possessions. These volumes are kept current by annual supplements and revisions. New editions of Coast Pilots are published as often as is warranted by the number of changes that have been made and the amount of new information available. Three supplements were published during the fiscal year. Field examinations were completed for new editions of three Coast Pilots (Puerto Rico and the Virgin Islands; Philippine Islands, part I; and Philippine Islands, part II), and the manuscripts prepared. A new edition of the Alaska Coast Pilot, part II, was published.

A brief outline on the various field projects covered by this Division in hydrographic, topographic, and coastal triangulation surveys, together with statistics of the amount of work accomplished under each survey follows:

Hydrography, topography, and coastal triangulation

Locality	Hydrography			Topography		Coastal triangulation		
	Sounding lines	Area	Soundings	Shoreline	Area	Length of scheme	Area	Geographic positions
	Miles	*Square miles*	*Number*	*Miles*	*Square miles*	*Miles*	*Square miles*	*Number*
Nantucket Sound	1,742	72	55,367	201	40			
North coast of Long Island						25	64	74
Hudson River	980	11	95,255					
Atlantic coast east of Fire Island	15,267	11,425	154,106	14				8
New Jersey coast	2,793	1,082	27,605					
Chesapeake Bay	3,575	143	131,290	217	150	25	57	62
James River, Va.						50	150	156
St. Johns River, Fla.	778	35	42,065	545	290			
Florida keys	1,552	145	56,382					4
Choctawhatchee Bay, Fla.	123	5	3,838	5				
Texas coast	18,115	18,074	204,222	107	30	6	6	9
Coast of northern California	1,899	1,083	11,788	11		12	15	11
Columbia River and coast of Washington	692	20	34,790	104		144	1,022	629
Willapa Bay, Wash.				70			11	13
Northern Puget Sound	245	14	8,027	41	23	10	15	29
Southeastern Alaska	2,128	86	68,593	144	69	91	262	126
Gulf of Alaska	6,890		11,110					
Alaskan Peninsula	10,628	5,921	123,557	143	375	29	75	11
Aleutian Islands, Alaska	6,887	7,256	86,879	562	382	128	1,130	125
Philippine Islands	15,167	3,370	200,141	101	47	31	191	54
Total	89,461	48,742	1,315,015	2,265	1,406	551	2,998	1,311

GEODETIC WORK

The geodetic work of the Bureau provides data in the form of latitudes, longitudes, elevations, azimuths, and distances, indispensable for mapping, for all classes of public works which deal with the land and for plans for the development and use of our natural resources.

Among the most important uses of control surveys, one that has been stressed but little in former reports is the use made by individuals of the triangulation stations as reference points for real estate as a certain means of perpetuating the boundaries of these holdings. Problems concerned with property boundaries, crop acreage, drainage, and the prevention of soil erosion with which various agencies dealing with agricultural-adjustment problems are concerned, particularly during recent years, are all more and more dependent on adequate maps, based on this Bureau's control surveys.

Five double-observing triangulation parties and three triple-unit level parties operated throughout most of the year, the work being done in 34 States.

Several circuits of triangulation and leveling, left unclosed by curtailment of funds in July 1935, were completed through an allotment of $490,000 of Public Works Administration funds for field geodetic surveys to supplement the control surveys of this Bureau, and the extension of operations into areas needing most urgent attention.

Some work was also done with the small regular appropriation and by the cooperation of other organizations furnishing funds necessary for the extension of control work.

One gravity party was in the field the entire year, except for one short interval required at the Washington office to test the apparatus.

An astronomical party also determined two gravity stations on the Aleutian Islands, Alaska, in addition to its regular work.

During the entire fiscal year this Bureau sponsored a computing office project in New York City as a Works Progress Administration project, with an average employment of 150 relief personnel. Adequate supervision was provided by the assignment of experienced officers and mathematicians from the permanent force. This office was also of material assistance in processing the large amount of field survey data resulting from the expanded program of 1933 to 1935.

On January 3, 1939, this Bureau initiated an office in Philadelphia, Pa., as a Works Progress Administration project, and at the end of June 1939 about 150 people were employed. Supervision was provided by details from the permanent staff.

Latitude observatories at Ukiah, Calif., and Gaithersburg, Md., which are maintained by this Bureau under international agreement for the determination of variation of latitude, were in continuous operation.

The following table gives a brief statistical summary of geodetic operations.

Geodetic work

Locality	Length of scheme	Area
FIRST-ORDER TRIANGULATION	*Miles*	*Square miles*
Grantsville-Tooele area, Utah	45	900
Erie to Boalsburg, Pa	155	1,705
Weber River area, Utah and Wyo.	115	2,925
Frazee to Remer, Minn	70	700
Long Prairie to Bemidji, Minn	115	1,230
Manti area, Utah	85	1,700
Minot to Westhope, N. Dak	60	600
Hudson River, Hudson to Albany, N. Y	60	660
Beaver River area, Utah	95	1,820
Laurel Hill, Fla., to Mobile, Ala. (including Niceville to Laurel Hill, Fla., and Pensacola to Century, Fla.)	180	1,620
Muddy River area, Utah	140	2,755
Waverly to Pocahontas, Iowa	120	1,200
Thomson to Polo, Ill	15	180
Circleville to Fairhaven and Wilmington to Springfield, Ohio	125	1,280
Dudley to St. Marys, Mo., and Scopus, Mo., to Elco, Ill	130	1,560
Fredericktown to Ironton, Mo	40	480
Vicinity of Selma, Ala	23	80
Lonoke, Ark., to Monroe, La., and Monticello to Arkansas City, Ark	205	2,050
Mobile to Demopolis, Ala	155	2,480
Earthquake investigation, Brea, Calif	9	36
Fields to Crane, Oreg	90	1,800
Vicinity of Crater Lake, Oreg	240	6,175
Lookout Mountain to Stanley, Idaho	50	1,100
Earthquake investigation, Point Reyes to Petaluma, Calif	50	1,500
Demopolis to Russellville, Ala	145	2,030
Winslow to Winkelman, Ariz	110	1,430
Silver City, N. Mex., to Nogales, Ariz., and Paradise, Ariz., to Deming, N. Mex	295	3,540
Childersburg, Ala., to West Point, Miss	120	1,200
Jackson, Ala., to Bassfield, Miss	85	850
Greensburg to Kingman, Kans	70	700
Manville to Thermopolis, Wyo	180	2,520
Mason to Forest City, S. Dak	165	2,310
West Point to Winona to Greenville, Miss	170	1,600
Marshall, Okla., to Siloam Springs, Ark	140	1,400
Centerville to Marshfield, Mo	95	950
Angie to Laurel Hill, La	90	720
Mexican boundary to Riverside, Calif	220	3,080
Mexican boundary to Baldwin Lake, Calif	305	4,380
Warm Springs to Strawberry, Nev.	130	1,560
Featherville to Stanley, Idaho	50	1,000
Monroe County, N. Y	30	800
Hornell to Owego, N. Y	95	1,140
Bolivar to Sheldon, Mo	65	780
Rockport to Waverly, Ill	50	500
Holton to Muncie, Ind	80	720
Liberty to Stilesville, Ind	85	765
Total	5,147	70,511
SECOND-ORDER TRIANGULATION		
Queen Creek area, Ariz	60	1,320
Kentwood to Garyville, La	55	500
Corpus Christi to Brownsville, Tex	140	840
San Clemente Island, Calif	3	3
Vicinity of Coronado, Calif	2	2
Vicinity of Riverside, Calif	15	45
Westinghouse Time Capsule, N. Y	3	3
Total	278	2,713
SECOND-ORDER BASE LINE		
Coronado, Calif	0.8	

Geodetic work—Continued

Locality	Length of scheme	Area
FIRST-ORDER TRAVERSE	*Miles*	*Square miles*
Earthquake investigation, Palmdale, Calif.	10.4	
Earthquake investigation, Gorman, Calif.	9.7	
Total	20.1	
FIRST-ORDER RECONNAISSANCE		
Manti area, Utah	85	1,700
Coalville to Mt. Lovenia, Utah	30	300
Hayward, Wis., to Baraga, Mich.	155	2,325
Oquawka to Galesburg, Ill.	30	300
Orr to Namakan Lake, Minn.	35	525
Beaver River area, Utah	95	1,820
Muddy River area, Utah	140	2,755
Thomson to Polo, Ill.	15	180
Rockport to Waverly, Ill.	50	500
Southwestern California	525	7,460
Success to Marshfield, Mo.	40	560
Laura to Watseka, Ill.	100	1,100
Angie to Laurel Hill, La.	85	680
Vicinity of Crater Lake, Oreg.	240	6,175

Locality	Length of scheme	Area
FIRST-ORDER RECONNAISSANCE—continued	*Miles*	*Square miles*
Washington County, Miss.	40	360
Winslow to Winkelman, Ariz.	110	1,430
McKittrick to Fresno, Calif.	180	3,960
Santa Barbara to Maricopa, Calif.	40	1,000
Sacramento to Round Top, Calif.	140	3,125
Hagerstown to Parkton, Md.	55	550
Thurmont to Point-of-Rocks, Md.	25	250
Sacramento River Valley, Calif.	270	5,300
Total	2,485	42,355
SECOND-ORDER RECONNAISSANCE		
Queen Creek area, Ariz.	60	1,320
Corpus Christi to Rio Grande, Tex.	135	1,080
Lucerne Valley to Helendale, Calif.	30	600
Wilsona to Fairmont, Calif.	60	1,050
Kentwood to Garyville, La.	55	500
Fairmont to Santa Barbara, Calif.	50	1,200
Total	390	5,750

State	First order	Second order
LEVELING	*Miles*	*Miles*
Arizona	10	264
Arkansas	115	159
California	524	1,141
Colorado	184	160
Idaho	15	177
Illinois	73	82
Indiana	69	96
Kansas		182
Kentucky	7	126
Louisiana	521	165
Maryland	15	16
Michigan	1	166
Minnesota	95	135
Mississippi	406	33

State	First order	Second order
LEVELING—continued	*Miles*	*Miles*
Missouri	6	163
Montana	8	61
Nebraska	63	811
Nevada		114
New Mexico	23	505
North Dakota	34	444
Ohio	26	1
South Dakota		358
Texas	93	560
Virginia		57
Wisconsin		70
Wyoming	43	150
Total	2,331	6,196

State	Determinations		
	Latitude	Longitude	Azimuth
ASTRONOMY			
Alabama	1	1	1
Alaska	1	2	2
Arkansas	1	1	1
Indiana			1
Louisiana	1	1	1
Nevada			1

State	Determinations		
	Latitude	Longitude	Azimuth
ASTRONOMY—con.			
New Mexico	1	1	1
New York	2	2	1
Texas			1
Total	7	8	10

State	Determinations	
	New	Repeat
GRAVITY		
Alaska	2	
Arizona	17	1
California	25	
Delaware	2	
Idaho	8	
Illinois	1	
Kansas	3	2
Maryland	8	1
Missouri	1	
Nevada	2	

State	Determinations	
	New	Repeat
GRAVITY—continued		
New Jersey	31	
New Mexico	3	
Oklahoma	14	5
Pennsylvania	2	
Texas	8	3
Virginia	3	
Wyoming	5	
Total	135	12

TIDE AND CURRENT WORK

Forty-six primary and 37 secondary tide stations were in operation: 38 on the Atlantic coast; 1 each in Bermuda, the Bahamas, and Cuba; 7 on the Gulf coast; 29 on the Pacific coast; 5 in Alaska; and 1 in the Hawaiian Islands. Of these, 40 were conducted in cooperation with other agencies including the U. S. Engineers, the Navy Department, Territory of Hawaii, City of New York, City of Santa Monica, City of Los Angeles, Port of Willapa Harbor, Woods Hole Oceanographic Institution, Chesapeake Biological Laboratory, and the University of Washington. Shorter periods of observation at approximately 100 additional stations were obtained in connection with hydrographic surveys and other activities.

Added emphasis has been placed on the tide and current work of the Bureau by the expansion of our Navy and merchant marine, as well as by the increasing commercial value of water-front property and the extension of oil fields to tidal waters.

Tide and current predictions and tidal current charts are an indispensable aid to navigation. Tidal datums are essential for harbor improvements, industrial planning, and the determination of boundaries of tide lands, as well as for use in the Bureau's surveying and charting operations. Basic data for these various purposes are derived from tide and current observations.

The tide survey of the Sacramento-San Joaquin Delta, for the precise determination of tidal datum planes and the investigation of changes in the tidal regime resulting from hydrographic changes, was continued throughout the year. The Connecticut River tide survey, in progress at the beginning of the fiscal year, was interrupted by the September 1938 floodwaters. The gages were reestablished in March 1939 and the project is now being continued in cooperation with the U. S. Engineers.

A Public Works Administration grant made possible the needed reconstruction and modernization of 40 of the principal tide stations.

No current surveys were conducted during the year. Some observations were secured by hydrographic parties and by cooperation from other agencies; three stations were occupied in Lower Bay, New York Harbor, in cooperation with the U. S. Engineer Office in New York. Through cooperation with the Lighthouse Service, hourly observations were obtained at Fire Island Lightship throughout the year and at Ambrose Channel and Scotland Lightships for a period of 4½ months. Cooperation was also extended to the Louise A. Boyd Arctic Expedition, 1938, which secured current observations at three localities in Greenland Sea. There are numerous localities along our coasts for which no information is available regarding the ebb and flow of the current. To meet the needs for such information, not only of navigation but also of engineering, fishing, and other interests, the program of making systematic current surveys should be resumed.

The demand for tide and current information was met through correspondence, tide and current tables, and miscellaneous publications, the latter including Tide Tables, Atlantic Ocean, 1940; Tide Tables, Pacific Ocean and Indian Ocean, 1940; Current Tables, At-

lantic Coast, 1940; Current Tables, Pacific Coast, 1940; reprint of Special Publication No. 208, Currents in Narragansett Bay, Buzzards Bay, and Nantucket and Vineyard Sounds; reprint of Special Publication No. 135, Tidal Datum Planes; revised editions of Tidal Current Charts for San Francisco Bay and Boston Harbor; and Tidal Bench Marks for the States of Washington, Alabama, Texas, and North Carolina. There was also issued a pamphlet covering the results of current observations taken in San Pedro Channel, Calif.

The reciprocal agreements between the United States and England, Germany, France, Canada, India, and the Netherlands for exchange of tide predictions for tide tables were continued.

In addition to the tabulation and reduction of tide and current observations and the prediction of tides and currents, tide notes were prepared and verified for 310 charts, planes of reference verified in 738 volumes of soundings, and descriptions and elevations of 585 bench marks furnished for use in connection with hydrographic, geodetic, and other engineering projects.

MAGNETIC WORK

The magnetic work of the Bureau consists of making observations and keeping records of the changes in the earth's magnetism. Changes in direction of the compass needle are of primary importance to the navigators on the seas and in the air, and to the surveyor in the location of boundaries previously surveyed with the compass. The changes in the horizontal and vertical intensities are of importance to the geophysical prospector in the location of natural resources and to investigators of radio transmission and for purely scientific studies.

The picture of magnetic declination for the United States is being greatly improved by observations obtained by magnetic observers attached to geodetic parties. The constant finding of new areas of local disturbance increases the importance of making magnetic surveys of the large areas about which no magnetic information is available. The Bureau is called on frequently to furnish certified compass data for use in court in the adjudication of boundaries and must continue to observe the magnetic elements in order to meet this requirement. The lack of a nonmagnetic ship makes the data furnished for this purpose and for nautical charts more and more unreliable, as accurate magnetic data cannot be determined with steel ships. Any uncertainty is a potential danger to life and property at sea.

Magnetic data were supplied for 170 printings of nautical charts. Publications issued during the year included a corrected edition of Serial No. 166, Directions for Magnetic Measurements; reprint of Special Publication No. 96, Instructions for the Compensation of the Magnetic Compass, for which there has been a large demand by other Government agencies; supplementary tables to bring Special Publication No. 117, The Earth's Magnetism, up to date; and Results for the Tucson Magnetic Observatory for 1929–30. The reduction and preparation for publication of Polar Year magnetic records were continued.

The distribution of magnetic observations during the year is shown in the following table:

State or Territory	Magnetic observations				
	Repeat			Other declination stations	Total
	New—complete	Old			
		Complete	Declination only		
Alabama				29	29
Alaska	1	2		54	57
Arizona				47	47
Arkansas				33	33
California		1		114	115
Colorado			3		3
Florida	2	3	1	5	11
Georgia		1			1
Illinois				31	31
Indiana				23	23
Iowa				31	31
Kansas		2	2	15	19
Kentucky			1		1
Louisiana		[1] 1		63	64
Maine				5	5
Massachusetts				1	1
Michigan		1	3		4
Minnesota		1	1	46	48
Mississippi			1	47	48
Missouri				79	79
Montana	2	4	1		7
Nebraska			1		1
Nevada	1			23	24
New Mexico				34	34
New York				1	1
North Carolina				1	1
North Dakota		2	2	15	19
Ohio	[2] 2		1	10	13
Oklahoma				18	18
Oregon				39	39
Pennsylvania			1	16	17
South Carolina	1	1			2
South Dakota			1	30	31
Tennessee		1			1
Texas				53	53
Utah	1			95	96
Vermont				17	17
Virginia				1	1
Washington	1	1			2
West Virginia			1		1
Wisconsin			2		2
Wyoming		1	2	42	45
Total	11	22	24	1,018	1,075

[1] Declination and horizontal intensity only.
[2] Dip not observed at one of these stations.

SEISMOLOGY

The seismological work consists in recording distant and local earthquakes; obtaining data by an elaborate system of questionnaires; exchanging information with many institutions; measuring the character and magnitude of natural periods of vibrations of structures and the ground; and cooperating with other Government agencies, scientists, and educational institutions in the study of causes and effects of earthquakes, so that means of safeguarding life and property from them can be devised.

Seismographs were operated at observatories in Tucson, Ariz.; Honolulu, T. H.; Sitka, Alaska; and San Juan, P. R. The Bureau cooperated in the maintenance of seismographs at nine colleges, three of which installed the instruments the past year. A number of

independent stations sent their records to the Bureau for study and interpretation.

Fifty-eight strong-motion seismographs for the recording of strong local shocks were maintained at 50 stations, and 16 records were obtained for 11 semidestructive earthquakes.

One hundred forty-four vibration tests were made in 5 buildings, and 172 ground-period tests at 80 locations. Similar work was done for the Navy Department at certain Navy bases. Shaking table tests were made on 7 instruments, thus obtaining approximately 400 records. Recording of fault noises in two deep wells was carried on intermittently throughout the year. Three tilt meter stations were maintained.

Intensive questionnaire coverage was obtained for 24 earthquakes of semidestructive character, and over 2,300 reports on approximately 400 earthquakes were received.

The seismological data are published in an annual report entitled "United States Earthquakes" and mimeographed quarterly reports. Many institutions requested photostat copies or loan of the original records.

NEW AND IMPROVED METHODS AND EQUIPMENT

The Dorsey Fathometer No. 3, having proved its value as a precision echo-sounding instrument on the *Westdahl*, has now been placed on the ships *Oceanographer*, *Surveyor*, *Guide*, and *Hydrographer*.

Sono-radio buoys have been tried out in Alaska and will be used by the four vessels operating along the Alaska Peninsula. These automatic buoys have now been successfully used to distances of 60 miles and have almost completely supplanted shore stations and the attendant danger of landing equipment through heavy surf.

Using a stock, light-weight commercial transit as a base, a new transit-declinometer was developed for magnetic declination observations. By test and replacement, all traces of magnetic material were removed from the basic instrument, now equipped with a specially designed microscope for precision reading of the magnetic needle.

Many instruments were fitted with better magnets made of new alloy materials.

An arrangement whereby it is possible to mount in succession three quartz horizontal magnetometers on a modified compass declinometer base has made it possible to determine station differences easily and quickly.

A new, all-metal magnetogram reading board was designed and built which is a great improvement over earlier types.

A log magnification attachment and special high-speed recorder for the Honolulu seismograph, built by the Honolulu observer in charge, permits the recording of strong local as well as distant shocks by the same instrument, at a decided saving of expense.

A special ground shaker, vibration meter, and recorder were designed and built to make ground and building vibration measurements to assist in the design of earthquake-resistant structures.

The illumination of theodolite circles was improved by a new design of lighting apparatus which reduces stray light, thereby enhancing the apparent sharpness of the graduation line.

Experiments conducted to determine the effect of various colors in the reading of level rods showed that a yellow-and-black combination provided longer sights and more speedy reading, thereby increasing the efficiency of geodetic leveling operations.

Redesigned signal lamps of all-metal construction eliminate moisture effects, reduce size and weight, and provide an accurately constructed and more sturdy lamp for triangulation purposes.

The program of reproducing the tide and current tables by the photo-offset process is being accomplished as rapidly as available personnel permits. In addition to the two current tables, Tide Tables, Pacific Ocean and Indian Ocean, 1940, were reproduced by this method at a substantial saving.

In the annual report for 1938, mention was made of a method for satisfactorily reproducing two or more gradient tints on aeronautical charts from one color printing plate, but it was not feasible to release employees from other duties to change over to the new method. Experiments have developed a supplement to this gradient tint printing, whereby gradients are made on one aluminum plate, the negatives for each of the colors being made from this one plate, reversed negatives being made to secure the alternate colors.

Several charts have been compiled on celluloid directly from the surveys, at a considerable saving of the compiler's time. This method is particularly applicable in areas where the charts to be constructed are at one-half the scale of the original surveys.

Chart notes were all reconsidered and a new form of tide, abbreviation, and authority notes was put into use, the notes being changed only when new printing plates are necessary for other reasons.

During the year a comprehensive tabulation of nautical chart symbols was prepared, to standardize the symbols used.

A new 14 by 17 inch copying camera, with a special tilting arrangement, has replaced the previous makeshift arrangements for this type of work.

The bromide room in the photographic laboratory has been completely renovated. New tanks of inconel metal and new light fixtures were installed and improvements made in the arrangement of the equipment.

The process room was enlarged and the equipment rearranged, by extending this room to take in a portion of the photographic laboratory.

A new instrument for cutting glass negatives for parallel lines to represent roads was devised, enabling the engraver to do this work with facility as compared with the previous rather unsatisfactory attempts.

The use of fluorescent tubes to replace the drafting lights behind the negatives in the lithographic sections has proved such a great improvement that these tubes will be installed gradually in all tables.

COOPERATIVE ACTIVITIES

The Bureau during the year has rendered the public and numerous Government agencies a service great in volume and variety. As this service is one without duplication, demands have increased as other functions of the Government have expanded. Economy of expendi-

tures has been accomplished although the demands have actually exceeded the volume of available service.

At the request of the Westinghouse Electric & Manufacturing Co., the Bureau determined the location of the "Time Capsule," deposited 50 feet in the earth at the site of their building in the New York World's Fair Grounds at noon on September 23, 1938. It is intended that this capsule, a repository of information concerning our mode of living at the present time, shall be recovered 5,000 years from that date. This Bureau furnished the chief of party and necessary instruments and the Westinghouse Co. all other items of expense.

In cooperation with the Geological Society of America, a series of six special charts was prepared delineating in detail the topographic forms of the ocean bottom on the northeastern Atlantic coast, in the vicinity of the coastal slope. Such charts are only now possible because they are based on the accurate and detailed surveys of the past few years, and are accordingly sought by all students of the earth sciences.

Cadet officers of the U. S. Maritime Commission were given instruction aboard vessels of this Survey, to familiarize them with its many activities benefiting the merchant marine officer. All the larger ships have at various times had from two to six cadets assigned for instruction during the field season on the Atlantic, Gulf, Pacific, and Alaskan coasts.

Science Service paid for the transmission of earthquake code messages from seismograph stations in the United States for the immediate determination of epicenters. The results of these immediate epicenter determinations are furnished in preliminary form to all cooperative stations and those with whom data are exchanged. The service is a definite aid to all the stations concerned and is meeting a constantly increasing demand.

Revision surveys of the Hudson River naval anchorages between Fifty-sixth Street and Yonkers were made by the tender *Gilbert* just prior to the arrival of the fleet. The work was begun while ice was still in the river, but by considerable effort the project was completed in time to permit the issue of charts to the Navy before arrival of the vessels. The finding of an unknown wreck by this field party, in ample time for the removal of the obstruction and the adjustment of the anchorage, proved a timely reminder of the need for such revision surveys. Other cooperative work for the Navy included the locating of beacons for use in fixing anchorage positions in Hampton Roads, Va., for the fleet, special hydrographic surveys in Alaska, and the determination of ground and building vibration characteristics for certain designated localities where a large construction program for naval use is in progress.

Two topographic quadrangle maps were engraved on glass negatives and reproduced for the Tennessee Valley Authority, and at the close of the year an order was received from that agency for the reproduction, by this method, of 10 additional topographic maps. There are being reproduced for the Authority a series of navigational charts of new lakes which have been created by some of the dams and which are being made into recreational areas. All Tennessee Valley Authority work was on a reimbursable basis.

In cooperation with the Army Air Corps, the Bureau, with its nine-lens camera, has taken photographs for the Soil Conservation Service of some 24,000 square miles of soil conservation areas in the High Rock section of North Carolina, in the Susquehanna region of Pennsylvania, and in Texas, Oklahoma, and Colorado, and has furnished transformed prints for use in planimetric mapping.

Extensive cooperation with the Civil Aeronautics Authority has resulted in the Bureau's doing a large amount of reimbursable work for that agency.

Special surveys in upper Chesapeake Bay and in the vicinity of Key West, Fla., were made on requests from the Bureau of Lighthouses. Two officers were assigned for part of the year to liaison duty, one at Norfolk, Va., and the other at Charleston, S. C. Other officers were assigned to temporary duty on lighthouse tenders in Washington, Oregon, and Puerto Rico. These officers instructed the personnel of the tenders in improved methods of position determination in order that greater accuracy might be obtained in the location of aids to navigation when established. Transported by the tenders to small isolated areas, they made revision surveys for corrections to the nautical charts.

During the winter season an officer from the ship *Guide* releveled the bench marks in Santa Clara Valley to check on the subsidence of the valley. This settlement, in progress for some time, is of considerable interest to California geologists and residents of the valley. Other than the chief of party, the personnel was made up of Works Progress Administration employees.

The Mississippi River Commission transferred a total of $26,500 to the Bureau for lines of leveling in the alluvial valley of the Mississippi from Baton Rouge, La., southward via New Orleans to the Head of Passes, and eastward as far as Bay St. Louis, Miss. Field work was completed in the spring of 1939 and the office processing of the material will be completed at the earliest opportunity.

Early during the year a project of local control for the metropolitan district of Baltimore was completed in cooperation with the officials of that city, which supplied all the personnel except the chief of party and instruments.

Triangulation and traverse were extended in three fault zones in the general vicinity of Los Angeles, Calif., as a continuation of the investigation of seismic regions and as recommended by the committee in seismology of the Carnegie Institution of Washington. The Bureau also repeated the triangulation from Point Reyes to Petaluma, Calif., originally done in 1930. Funds for this work were obtained through a special item of appropriation by the Seventy-fifth Congress.

At the request of the city engineer of Riverside, Calif., 10 triangulation stations were established within the city and vicinity to provide control for the city's plane-coordinate system. Expenses of the work were paid by the city and county.

Additional cooperation was extended to Works Progress Administration local control survey projects in 14 States and to King County, Wash., Mercer County, Pa., Minneapolis, Minn., and Cleveland, Ohio, by the loan of equipment or detail of personnel in an advisory capacity, in order to coordinate local surveys into the national net.

Seismographs were operated in cooperation with the following institutions: University of South Carolina, University of Chicago, Montana School of Mines, Montana State College, University of Utah, Nebraska Wesleyan University, University of Hawaii, University of Alaska, Woods Hole Oceanographic Institute, and the Bermuda Biological Station. The Jesuit Seismological Association operated a number of seismographs and close cooperation was maintained in the exchange of records and data.

Tilt meters for determining the earth's tilt and its relation to seismology were continued in cooperation with the University of California.

Information regarding the effects of occurring earthquakes was obtained with the assistance of the Weather Bureau, several universities, many commercial agencies, and individuals.

The following activities were continued with the cooperation of the department of terrestrial magnetism, Carnegie Institution of Washington: Operation of a cosmic ray meter at Cheltenham Observatory; maintenance at Cheltenham Observatory of international magnetic standards; atmospheric and earth electric currents at Tucson Observatory (Mountain States Telephone & Telegraph Co. and Bell Telephone Laboratories also cooperating); and daily and weekly radio broadcasts of magnetic conditions, in which the Navy Department and Science Service also aided.

LIGHTHOUSE SERVICE

The total number of aids to navigation maintained by the Lighthouse Service at the close of the fiscal year was 29,606, a net increase of 849 over the previous year. Of the additional aids established, 377 were lighted aids, 42 were sound signals, and 457 were unlighted buoys and daymarks.

During the fiscal year radiobeacons were newly installed at 8 additional light stations. Of these new radiobeacons 4 were on the Atlantic and Gulf coasts, 2 upon the Pacific coast, and 2 upon the Great Lakes. This number included the first radiobeacon buoy to be placed in service in the United States, known as North Channel Radiobeacon Buoy No. 10, and located in Boston Harbor, Mass. The grand total of all United States radiobeacons is now 141.

Radiobeacon signals were synchronized with sound-in-air fog signals for distance-finding purposes, at 1 additional station during the year, bringing the total number of stations having such synchronized signals to 92.

The President's Reorganization Order No. II provided for the consolidation of the United States Lighthouse Service with the United States Coast Guard in the Treasury Department and its administration as a part thereof. By an act of Congress the effective date of the change was fixed for July 1, 1939.

In 1910 when the Lighthouse Service was established as a Bureau, there were 12,082 aids to navigation of all kinds, while at the close of the present year the number stood at 29,606. More striking than this increase of nearly 150 percent in the number of aids is the number of employees at the beginning and close of the period. In 1910 there were 5,778 employees required to maintain slightly more than 12,000 aids to navigation, while in 1939 the number of employees had dropped to 5,355, despite the large increase in the number of aids, noted above. The great increase in the number of navigational aids in the past 29 years has been due very largely to the introduction and further development of various types of automatic apparatus, making it practicable to maintain aids at a large number of points which could be so effectively marked only at a very large expense if it were necessary that each station be supplied with resident personnel.

The use of automatic apparatus, and the consequent increase in the number of the smaller unattended lights, is connected in the closest manner with the changes which have been made in recent years in the illuminants used for the aids to navigation. The following statements not only indicate the changes in apparatus which have been taking place but, indirectly, the increase in the number of automatic lights with which the Service has marked the waterways of the country.

Most important changes have taken place in the illuminants used for the aids to navigation. Three principal types, namely, kerosene

oil, acetylene and other gases, and electricity, were in use in 1910 and also in 1939, but the percentages have undergone radical changes. In 1910 there was a total of 4,036 lighted aids to navigation; of these, 97½ percent employed kerosene oil, 2 percent used acetylene gas, and one-half of 1 percent used electricity. In 1939, with a total of 9,862 lighted aids to navigation, the conditions had so much changed that only 27 percent employed kerosene oil, 33 percent used acetylene gas, and 40 percent used electricity. These figures indicate the manner in which the actual illuminant source has changed, but only partially tell the story of advancement, for under these three general headings there has been introduced apparatus not heard of in 1910, particularly among the electrically lighted lights. Also underlying these figures is the continuing increase in the percentage of automatic lights, made practicable only through the introduction of acetylene and electric apparatus, and accounting in a large measure for the rapid proportional as well as numerical increase in the use of such apparatus.

1910 marked the approximate close of the period in which the Lighthouse Service was developing the kerosene-oil wick lamp. In this country and abroad, the simple single-wick burner on the Argand principle had passed through a long period of evolution, in which various means had been adopted to secure a constant level of the oil about the wick, and in which the wicks, cylindrical in shape, had increased in number, one inside the other, until five and six concentric wick burners were in common use. A point had been reached where it was quite unlikely that any further brilliance could be extracted from a given quantity of oil by this means.

When it seemed that the ultimate results from kerosene as a lighthouse illuminant had about been obtained, a new development, the incandescent oil-vapor lamp, became available. This type of lamp, burning vaporized kerosene under a mantle, was used in many of the larger seacoast lights, and produced a very brilliant light on a moderate consumption of oil. This highly efficient light source is still in service at many points where electric power is not economically available.

For a great many of the attended lighthouses of today the electric light is the most practicable, the same source of current which supplies the light also providing a means of operating the fog signal where this is desirable, operating a radiobeacon, and lighting the shops and quarters of the keepers. Curiously enough, the Lighthouse Service first experimented with electric light at about the same time that it was introducing kerosene as a lighthouse illuminant, but the use of electricity remained impracticable at many lighthouses for a number of years because of the lack of dependable commercial sources of current, the fact that many lighthouses were so remotely located that the supply of current over pole lines was not to be looked for, and the lack of suitable equipment for generation on station. The electrification of lighthouses was due largly to two factors: First, the commercial development of highly efficient incandescent lamps and reliable electric-generating equipment which could be installed at individual stations and operated by existing personnel, and second, the introduction of radiobeacons, for which electric current quite naturally had to be provided. Largely because of these factors,

and the increased availability of commercial power, important light stations have now been largely electrified.

The development of the radiobeacon system is entirely the work of the period just past, these radiobeacons and their application in the navigation of ships being perhaps the most important development in lighthouse engineering in the past half century. The first United States radiobeacons were established in 1921, being 3 in number, and from that time on they were placed at lighthouses and upon lightships with considerable rapidity. At the end of 10 years, 89 had been made available to mariners, and at the close of the present fiscal year the number has increased to 141. Every lightship is now equipped with a radiobeacon, and they are also installed at the more important light stations.

Outstanding developments were also made during the past 29 years in the marking of the coasts, entrance channels, and other waterways by means of buoys. Not only has the numerical increase in this class of aid been most substantial, but a far greater percentage now than formerly are fitted with light or sound signals. In 1910 only 224 of the buoys in United States waters were fitted with lights, while today there are nearly 1,900 lighted buoys in service. In the same period buoys having whistles have increased from 95 to 226. Bell buoys have increased from 183 to 804, and the unlighted buoys have more than doubled in number, the figures being 6,090 in 1910 and 13,468 at the present time.

Extensive damage to Lighthouse Service property distributed over a wide area in New York, Connecticut, Rhode Island, and Massachusetts was caused by the hurricane which swept the North Atlantic coast on September 21. An assistant keeper of a station in Narragansett Bay lost his life, the wife of another keeper was drowned, and in a third case a keeper lost both wife and son. In addition, other persons who had sought refuge at a light station were drowned. The area of greatest damage included the eastern coast of Connecticut, the entire coast of Rhode Island, and that portion of the Massachusetts coast lying to the westward of Cape Cod. The damage was particularly severe in the neighborhood of New London, Conn.; Narragansett Bay, R. I.; and Buzzards Bay, Mass. The most easterly point from which damage was reported was Eastern Point Light Station, Gloucester, Mass.

The tower of Whale Rock Light Station, in the western passage of Narragansett Bay close to Narragansett Pier, was completely swept from its base and destroyed. In this catastrophe, the first assistant keeper, Walter B. Eberle, the only person at the station at the time, lost his life.

At the Palmer Island Light Station, in New Bedford Harbor, Mass., the dwelling and all other buildings, with the exception of the light tower, were swept away. The wife of the keeper, Mrs. Arthur A. Small, who had first taken refuge in the tower, lost her life in an attempt to go to the assistance of her husband when she saw him washed away by a heavy sea. Mr. Small displayed fortitude of the highest order, when, after seeing his wife washed away, he went back to his post, remaining throughout the storm and keeping his light in operation until he was relieved the following morning.

The Prudence Island Light Station, in the eastern passage of Narragansett Bay, was entirely destroyed with the exception of the tower which remained standing although somewhat undermined. The keeper's wife and son were drowned when the dwelling was finally destroyed, and the keeper was able to save himself only after being swept more than a quarter mile from the station. During the height of the storm a former keeper of the light and two others who sought refuge in the dwelling were drowned.

Bullock Point Light Station, in the Providence River, was damaged to such an extent that the dwelling was not habitable and the tower was unsafe. All furnishings, supplies, and boats were washed away.

The lighthouse depot at Bristol, R. I., suffered extensive damage; gravel fill was washed away and fences were destroyed. Every buoy, at the time stored on the wharf, and a number of ballast balls and acetylene tanks were washed overboard, some drifting on shore and into the upper harbor. Two boats were sunk near the wharf. The keeper's dwelling and the storehouse were badly damaged and stock and stores were damaged by water.

The Wings Neck Light Station, in the upper end of Buzzards Bay, was badly damaged; all structures were rendered so unsafe that the keeper was unable to remain and had to employ an emergency light.

At the New London lighthouse depot, the wharf and storehouse were considerably battered, much of the apparatus in storage was damaged, and buoys and appendages were washed away and damaged.

The lighthouse tender *Tulip* was thrown bodily upon the shore at New London, Conn., in such a manner that it obstructed a main-line railroad track passing through that city. A contract was awarded a wrecking company, and the *Tulip* was successfully floated. The damage to the ship was found to be comparatively small, all conditions considered; it was repaired and the vessel was returned to service.

At the lighthouse depot at Woods Hole, Mass., the damage was extensive. Fill on the premises was badly washed out, small buildings were seriously damaged, and buoys and other objects stored on the property were scattered about, some being thrown up onto private property.

Extensive damage was done to many light stations in the path of this storm, other than those already mentioned, consisting in general of the destruction of small boats, damage to foundations, the breaking in of windows and doors and consequent flooding, the destruction of power lines, and the derangement of other exposed apparatus. In New York State, on Long Island or Long Island Sound, the principal damage occurred at the following light stations: Latimer Reef, North Dumpling, Race Rock, Little Gull Island, and Orient Point. In Connecticut the stations seriously damaged were the following: Saybrook Breakwater, Falkner Island, New London Ledge, and Seaflower Reef. In Massachusetts extensive damage was also done at Dumpling Rock. In Rhode Island serious damage was experienced at a number of stations, including Pomham Rocks, Sabine Point, Newport Harbor, Castle Hill, Beavertail, Dutch Island, Warwick, Point Judith, Watch Hill, and Block Island Southeast.

An allotment of $1,680,000 was made by the Public Works Administration at the beginning of the fiscal year, for the construc-

tion and reconditioning of lighthouse tenders and lightships. Bids were opened on August 10 for the construction of seven new lighthouse tenders, all but one of which were to be built with these funds. In order that these vessels might be placed under construction as soon as possible, they were built from plans of existing vessels which had recently been designed. Bids were submitted for two vessels of the *Hollyhock* class, one vessel of the *Jasmine* class, one vessel of the *Lilac* class, one vessel of the *Elm* class, and two vessels of the *Goldenrod* class. Only one vessel of the *Goldenrod* class was eventually built. At the close of the fiscal year the tenders *Fir* and *Walnut*, of the *Hollyhock* class, were practically ready for delivery; the *Bluebonnet*, of the *Jasmine* class, was 67 percent completed; the *Mistletoe*, of the *Lilac* class, was 72 percent completed; the *Birch*, of the *Elm* class, was 62 percent completed; and the *Poplar*, of the *Goldenrod* class, and the *Zinnia*, *Narcissus*, and *Maple*, sister ships of a new design, had been delivered. The last three vessels and the *Walnut* were built with funds provided for special vessel projects.

The superintendents of the 17 lighthouse districts assembled in Washington on October 6 for a 10-day conference. The last previous similar conference was held in 1935. The sessions were devoted to the coordination of technical and administrative procedures in the interest of uniformity and increased efficiency in all areas. On October 14 the superintendents went to Cape Henry, Va., for the purpose of witnessing tests of newly developed types of fog-signal apparatus.

The extension of the civil-service principle to additional groups of Lighthouse Service personnel has progressed considerably during the past year, as the result of two Executive orders. The order of March 29, 1938, brought some 365 petty-officer positions and some 40 light-attendant positions under the classified civil service. Under the Executive order of June 24, 1938, about 35 positions of steward on lighthouse tenders were brought under the classified civil service. A much-desired result of placing petty officers in the classified civil service is to provide for the promotion of suitable incumbents to deck- and engineer-officer positions. The result so far has been very gratifying. Another important step in personnel administration was the holding, during the year, of the first assembled written examination for lighthouse keepers.

Experimental service tests of a battery-operated, short-range, radiobeacon transmitter fitted to a large buoy were made during the year in Boston Harbor, Mass., and favorable comments upon the effectiveness of this new form of navigational aid were received from mariners. The radiobeacon transmitter, the special antenna, and the power supply layout were developed at the Lighthouse Service radio laboratory in cooperation with Bureau engineers, although preliminary tests using adaptations of commercial equipment were made on a buoy in New York Harbor some 2 years ago.

The dual transmitter in its present form is housed in a cylindrical container 2 feet in diameter and about 3 feet long. It is placed in one pocket of a 9–38–W buoy and connected by cables to a monel-metal spike antenna about 15 feet long, the latter mounted, with its tuning unit, atop the buoy superstructure.

There are numerous locations where a well-developed and dependable buoy radiobeacon would serve navigational needs more effectively than other aids practicable of establishment at reasonable cost. If the present tests and development are successful, it is anticipated that this form of aid will find considerable application in the Lighthouse Service, both on fixed sites and on specially designed buoys.

The coordinated system of radiobeacon operation which was adopted on all coasts of the United States and Canada in 1935, has been further extended into Central American waters through the cooperative action of the Tropical Radio Co. and the United States Lighthouse Service. Changes in operating periods or other characteristics at three important radiobeacon stations of the United States were made on January 1, 1939, and the Tropical Radio Co. made changes in five of its stations at the same time. These changes have produced a substantially uniform system of marine radiobeacons in a great area of navigable waters. From the Pribilof Islands, far west of Alaska, to the Hawaiian Islands and to the Republic of Panama and the Canal Zone on the Pacific, thence to Mona Island in the West Indies and up the Atlantic seaboard to the Labrador coast is the approximate boundary of the area included, in which all marine radiobeacons operate with a systematic uniformity so desirable to the mariner using these aids.

Lightship *No. 118*, built specially for the Cornfield Point Lightship Station in Long Island Sound just to the westward of New London, Conn., was placed on station for the first time on April 25. This new second-class lightship embodies an unusual number of safety features and is fitted with the latest types of signalling equipment. Although smaller than Lightship *No. 112*, on the Nantucket Station, and intended for service on less exposed stations, the new ship, particularly in the design of the hull, is in many respects patterned after that vessel.

The radio laboratory, heretofore maintained at the shops of the lighthouse depot in Detroit, Mich., was moved on February 1 to the Lazaretto Lighthouse Depot in Baltimore, Md., where a building had been constructed providing more adequately for this important branch of the work of the Service. Over the past 15 years especially, the Lighthouse Service has made many important adaptations of radio to its work of safeguarding navigation, a work in which its radio laboratory has played an important part. Through this change in location, the laboratory is brought to a point where it is not only more directly accessible for supervision by the Bureau's technical staff in the study of these problems, but is now so located as to be more central to the radio industry and at a point where navigation is open for the entire year and vessel facilities for practical tests thus available at all seasons.

The completion of the Bonneville Dam on the Columbia River, and the use of the upper reaches of the river by ocean-going ships as a result, created a need for an increased number of navigational aids and thus added to the work of the seventeenth lighthouse district. By the close of the fiscal year, 65 new aids had been established in the upper parts of the river with funds provided by the Public Works Administration.

ADMINISTRATION

Appropriations for the maintenance of the Lighthouse Service totaled $12,574,600 for the fiscal year 1939. There were also allotted from 1939 Department appropriations $6,000 for contingent expenses, $39,000 for printing and binding, and $87,175 for traveling expenses.

There were received and deposited in the Treasury the following: From sale of Government property, $36,676.43; rent of buildings, etc., $1,459.10; reimbursement for property destroyed or damaged, $5,297.38; work done for private interests, $624.72; commissions received on telephones, $28.17; miscellaneous, $4,876.57; total, $48,962.37.

An act of Congress approved June 2, 1939, authorized the Secretary of Commerce to convey 110 acres of the Umpqua River Lighthouse Reservation, State of Oregon, to the State for park purposes.

An act of Congress approved June 13, 1939, authorizes the conveyance by the United States to the town of Bristol, Maine, of a portion of the Pemaquid Point Lighthouse Reservation, for park purposes.

The year 1939 marked the one hundred and fiftieth anniversary of the initiation of lighthouse activities under the Federal Government. On August 7, 1789, the first United States Congress by the ninth act which it passed, provided that lighthouses, buoys, beacons, etc., which had previously been erected and maintained by the various colonies, be henceforth supported by the Federal Government. This act, by providing for the erection and maintenance of lighthouses and other aids to navigation, was the origin of the United States Lighthouse Service, and apparently was the first act of Congress providing for a definite Federal service which was not already specifically provided for in the Constitution.

Suitable observance of the one hundred and fiftieth anniversary of the Lighthouse Service was called for by a joint resolution of Congress, signed by the President on May 15, which was known as Public Resolution No. 16. By this resolution the week of August 7, 1939, was designated lighthouse week.

On February 20 the dividing point between the eighth and fifteenth lighthouse districts, upon the Mississippi River, was changed, transferring that portion of the river lying between mile 838.0, just north of Baton Rouge, La., and the city of New Orleans, to the jurisdiction of the eighth lighthouse district. This change has the effect of placing in the eighth district all portions of the Mississippi River having channels of such depth as to make them available for ocean navigation.

IMPROVEMENTS IN APPARATUS AND EQUIPMENT

Electrification of important light and buoy stations has been continued with increase of candlepower and accompanied by modernized living conditions for keepers.

Additional tests and analyses of fog signals were carried out at the Cape Henry Fog Signal Testing Laboratory during the year. A composite signal unit comprising three electric diaphragm oscillators driven from commercial alternating current power supply was tested and proved very effective, comparing favorably as to range with first-class signals. Power requirement was only about 28 per-

cent of that used for an F-type diaphone. The unit will be installed at a suitable point for regular service and further observations.

During the year there was developed on specifications prepared by Lighthouse Service engineers an automatic sound-operated control unit that will place a fog signal in operation whenever a ship's fog whistle is sounded in fog or thick weather. Such a unit was built and is in service at an unattended fog-signal station. This unit makes possible the sounding of the fog signal at an unattended station only when needed.

Development has progressed on the plunger type electric solenoid operated bell strikers and their use is being extended to points where a bell signal is adequate. The power consumption is small and batteries may be used for an unattended station.

The light beam remote-control apparatus for starting and stopping a remote fog signal either manually or as a function of change in visibility has been improved and shipped to the Pacific coast for regular service installation.

Public Works Administration allotments have made possible the purchase and installation of modern compressed-air fog-signal equipment to replace bells and obsolete types of equipment at a number of stations.

A lamp changer carrying 17 lamps has been developed by a supplier of Lighthouse Service equipment, permitting of its use in a special 300 mm. lantern to produce much higher candlepower than formerly attainable from buoy lanterns. This is accomplished by over-voltaging the lamp—the shorter life of lamps before burn-out being taken care of by the automatic lamp changer. Some of these units are being purchased for important lighted-buoy locations.

Synchronization of sound and radiobeacon signals for distance-finding purposes has been extended during the year.

A portable indicator, consisting of a single headphone, neon tube, transformer, and switch, to provide an extension unit for any standard radio direction finder, has been developed at the radio laboratory. This indicator permits the navigator to use the neon tube for visual reception of distance-finding radiobeacon signals at any point in the pilot house within the scope of a portable cord. This avoids the possible distracting effects of audible radio signals when navigating in close quarters. Trials of these portable indicators are being made on several lighthouse tenders and favorable reports have been received.

As previously noted, the Lighthouse Service Radio Laboratory has been moved to Baltimore, Md., nearer the center of the radio industrial manufacturing area, where closer contact can be maintained between the laboratory and the Bureau.

Modernization and replacement of obsolete types of radiobeacon transmitters and associated control equipment, much of which is 10 to 15 years old, has been continued during the year to include practically all of the older radiobeacon stations from Public Works Administration funds allotted for this purpose. Crystal frequency-controlled exciters and radiobeacon transmitters for operation with or completely to replace obsolete equipment in order to comply with international frequency regulation has played an important part in this program for modernization of the radiobeacon system.

Vertical antenna towers with advantages in transmission and propagation of radiobeacon signals have been installed during the year to the benefit of many aids to navigation. Where limited space or power consumption prevented large transmitters from being installed and where the same effect could be realized by use of a smaller transmitter in conjunction with a vertical radiator, these antennas have been found particularly effective.

To keep abreast of the improvements made in radiobeacon transmitting equipment, a new signal timer unit known as type LSR 706 has been developed for accurately controlling the functions of radiobeacon stations automatically. Improvements in receivers and monitoring alarm devices also have materially aided in the maintenance and improved the monitoring of radiobeacon station transmissions.

A selective radiotelephone signalling system has been developed to enable attendants to be continuously available on call through communications facilities of radiotelephone stations in the Service.

The installation of radiotelephone facilities has been rapidly advanced so that now there are approximately 200 such stations. This facility has proved to be an important adjunct in the administration of the Service and is also used in some cases to the advantage of the mariner in scheduled broadcasts of hydrographic and weather information.

Radio remote control has been further developed in the Service to the extent that two shore stations and one lightship have continued without interruption to use this system. Improvements are being made in this type of facility in the construction of equipment for three additional offshore station structures which will be entirely remote-controlled from shore points some miles away.

A number of older lighthouse tenders and new vessels have been equipped with modern radio direction finder equipment in order to improve the navigation apparatus of the vessels themselves and at the same time better patrol the radiobeacon system.

Field trials of a buoy radiobeacon have been carried out in the Boston district since February 1939 with gratifying results. Various maintenance problems are successively being overcome and an aid to navigation is being developed which has a maximum service value within the limitations of buoy service in open sea.

Favorable comments have been received from a number of ships using the aid in its preliminary developmental stages which indicate the possibility of many applications for it in the future. This short-range radio aid of 3 to 5 miles, guarding channels and entrances in close navigation requirements, will assist vessels to navigate under adverse weather conditions where visual and sound signals are ineffective.

Similar equipment has been developed and constructed for use as secondary "marker radiobeacons" at fixed station sites and several sets of equipment now under construction will be placed in commission shortly at various points where needs have long existed for such aids.

PERSONNEL

The total personnel of the Service as of June 30, 1939, was 5,355, consisting of 4,199 full-time and 1,156 part-time employees, the

former including 1,170 lightkeepers and assistants; 56 light attendants; 1,995 officers and crews of lightships and tenders; 113 Bureau officers, engineers, and draftsmen, and district superintendents and technical assistants; 226 clerks, messengers, janitors, and office laborers; 157 depot keepers and assistants, including watchmen and laborers; and 482 field-force employees engaged in construction and repair work. The total personnel indicated represents a net increase during the fiscal year of 166 in the authorized personnel for the operation and maintenance of the Service, approximately 100 of the increase having been for the better manning of vessels and for the commissioning of new ones.

During the year, in addition to their regular duties, a number of employees rendered aid to those in distress; 113 instances of the saving of life and property or the rendering of other valuable aid were reported, many of which acts were performed at great personal risk.

Changes in the superintendents of three districts were made during the year. In the sixth district, Henry L. Beck was retired June 1, 1939, when Assistant Superintendent W. G. Wallace assumed the duties of acting superintendent. W. H. Barton was appointed superintendent in the ninth district on July 24, 1938, succeeding F. C. Hingsburg who was transferred to the seventeenth district succeeding Edward C. Merrill, who was transferred to the eighth district July 1, 1938.

LIGHTHOUSE TENDERS

At the end of the year, the total number of lighthouse tenders was 65, of which 64 were in commission and 1 was out of commission and advertised for sale. Of the vessels in commission, 42 were steam-propelled, 18 had Diesel engines, and 4 had Diesel-electric drive. The average age of the fleet of tenders is 19.52 years. There are 10 tenders, aggregating 8,535 tons, 35 years of age and over.

Thirty lighthouse tenders are equipped with radiotelegraph; 38 with radio direction finders; and 55 with radiotelephones.

Four new tenders, the *Maple*, *Narcissus*, *Poplar*, and *Zinnia*, were completed and commissioned during the year. Contracts for the construction of five additional tenders, the *Birch*, *Bluebonnet*, *Fir*, *Mistletoe*, and *Walnut*, were awarded August 16, 1938, and the vessels are now under construction.

The following lighthouse tenders were extensively overhauled or reconditioned during the year: *Cypress*, *Sequoia*, *Spruce*, *Tulip*, and *Wakerobin*.

It is expected that the following tenders will be overhauled or reconditioned during the coming year: *Beech*, *Palmetto*, *Hyacinth*, and *Manzanita*.

During the year the following tenders were sold: The *Pine* on September 6, 1938, and the *Sumac* on September 22, 1938.

LIGHTSHIPS

Lightships were maintained on 30 stations during the year. At the close of the year, the total number of lightships was 43, which included 9 relief ships and 4 ships out of commission.

Lightship *No. 118* was completed during the year and placed on the Cornfield Point Station, Conn., on April 25, 1939. The vessel is described elsewhere.

During the year, Lightships *No. 79*, *No. 84*, *No. 90*, *No. 100*, and *No. 107* were extensively overhauled or reconditioned. It is expected that similar reconditioning will be accomplished during the coming year on Lightship *No. 93*.

PROGRESS OF VESSELS UNDER CONSTRUCTION

Lightship "No. 118".—This vessel was constructed under a contract with the Rice Bros. Corporation, East Boothbay, Maine, at a cost of $223,900, to replace Lightship *No. 44* on the Cornfield Point Station, Conn. The hull below the main deck is subdivided into an unusually large number of watertight and oil-tight compartments. The protection is considerably increased by dividing the space above the main deck into watertight passages and compartments. Diesel engines are provided for main and auxiliary power, including the operation of the signalling equipment. The latter is of the latest types and consists of a radiobeacon, a compressed-air fog signal, a powerful masthead light, and a warning whistle. The radiobeacon and air fog signal are synchronized for distance finding. Official trials were held on August 24, 1938. The vessel was accepted on September 11, 1938, and was placed on station April 25, 1939.

Tenders "Maple," "Narcissus," and "Zinnia."—These three small tenders, of the same design, were completed during the year, and were assigned to the tenth, fourth, and seventh districts, respectively. The *Narcissus* and *Zinnia* were constructed under a contract with the John H. Mathis Co., of Camden, N. J., at a contract cost of $440,046 for both vessels. The *Maple* was constructed under a contract with the Marine Iron & Shipbuilding Co., of Duluth, Minn., at a contract cost of $190,000. These tenders are 122 feet 3 inches in length overall, 27 feet in breadth, and displace approximately 342 tons at a draft of 6 feet 6 inches. They are propelled by two direct reversible Diesel engines, each connected to its propeller shaft by reduction gears. These vessels are of approximately 40 percent welded construction, welding being used principally on the longitudinal and transverse framing members and on the deck and bulkhead plating. This is a progressive departure from the all-riveted construction formerly used for Lighthouse Service vessels. Another new design feature is a tripod type of mast, eliminating the usual shrouds and backstays, and facilitating the use of the derrick with which it is fitted. A modified flat plate keel, having a heavy, flat bar welded outside the plating, is being used for the first time in this Service. This construction results in the vessel's being of less draft than if fitted with a standing bar keel, eliminates objectionable docking features of the orthodox flat plate keel construction, and, as applied in these tenders, adds considerably to the strength of the keels. The buoy-lifting gear has a safe working capacity of 10 tons, which is large for so small a craft. The *Zinnia* was delivered on March 28, 1939; the *Narcissus* on April 27, 1939; and the *Maple* on June 6, 1939.

Tender "Poplar."—This tender was completed during the year and was assigned to the fifteenth lighthouse district. It was constructed under a contract with the Dubuque Boat & Boiler Works, Dubuque, Iowa, at a cost of $123,200. The hull is of special design with the propellers in twin tunnels and especially adapted to work in the shallow waters of the interior rivers. It is provided with jetting equipment for securely placing buoy moorings in the bottoms of rivers. The vessel is of steel, 104 feet long, and has twin propellers driven by two Diesel engines of 150 horsepower each, through reduction gears. The displacement is 170 tons at a draft of 3 feet 6 inches. The derrick has a working load capacity of 2½ tons. The official trials were held on June 2, 1939, and the tender was placed in commission very shortly thereafter.

Tenders "Walnut" and "Fir."—These tenders are being constructed under contract with the Moore Dry Dock Co., Oakland, Calif., at a contract cost of $779,493, for both vessels. When completed, the *Walnut* will be assigned to the eleventh lighthouse district, and the *Fir* to the seventeenth lighthouse district. These tenders are to be all-steel vessels, 174 feet long, twin-screw, steam-propelled, with oil-burning boilers and engines of 1,000 horsepower. The main engines of the vessels are to be of the vertical, inverted type, triple expansion,

with cylinders 11½, 19, and 32 inches by 24-inch stroke. Steam will be generated by oil-burning water-tube boilers designed for a working pressure of 225 pounds. The tenders will have a displacement of about 825 tons on a draft of 10 feet 7 inches. The lifting gear, designed specially for the handling of buoys, etc., will have a safe working capacity of 20 tons. The vessels will be fitted with gyrocompasses and repeaters, radiotelephone communication, and fathometers. The official trials of the *Walnut* were held on June 27, 1939. Preparations were immediately started for the delivery trip to Detroit, Mich. On June 30, 1939, the *Fir* was approximately 92 percent completed.

Tender "Mistletoe".—This tender is being constructed under contract with the Pusey & Jones Corporation, Wilmington, Del., at a contract cost of $378,800. When completed, this tender will be assigned to the fifth lighthouse district. The vessel is to be of all-steel construction, 172 feet long, twin-screw, steam-propelled, with oil-burning boilers and engines of 1,000 total horsepower. The main engines of this vessel are to be the vertical, inverted-type, triple-expansion, with cylinders 11½ by 19 by 32 inches diameter by 24-inch stroke. Steam will be generated by oil-burning water-tube boilers designed for a working pressure of 200 pounds. The tender will have a displacement of 770 tons at a draft of 8 feet 6 inches. The derrick gear, designed specially for the handling of buoys, etc., will have a working lifting capacity of 20 tons. The vessel will be fitted with radiotelephone communication. On June 30, 1939, this tender was 76.4 percent completed.

Tender "Bluebonnet".—This tender is being constructed under contract with the Dubuque Boat & Boiler Works, Dubuque, Iowa, at a cost of $132,500. When completed, this tender will be assigned to the eighth lighthouse district. The vessel is to be of steel, 91 feet long, with twin screws, propelled by two Diesel engines of 100 horsepower each, and will have a displacement of 184 tons at a draft of 5 feet 3 inches. The derrick has a working lifting capacity of 2½ tons. On June 30, 1939, this vessel was 67 percent completed.

Tender "Birch".—This tender is being constructed under contract with the General Ship & Engine Works, East Boston, Mass., at a cost of $74,000. It has been specially designed for the maintenance of buoys and other aids to navigation in the shallow rivers and other inland waters of the third lighthouse district. The vessel is of steel, 72 feet long, with twin screws, and is propelled by two Diesel engines of 150 horsepower each. It will have a displacement of 69 tons at a draft of 3 feet 8 inches. The derrick has a working capacity of 1 ton. On June 30, 1939, this tender was approximately 62 percent completed.

PROGRESS OF SPECIAL WORKS

[NOTE.—Projects under $10,000 are not included herein]

Cleveland Ledge, Mass.—See annual report, 1938, page 133. An allotment of $175,000 has been made for the erection of a new first-order light, fog signal, and radiobeacon station in Buzzards Bay in the southern approach to the Cape Cod Canal. This structure will stand in approximately 16 feet of water on a submarine site 2 miles from land. It will mark the channel between two dangerous ledges. A survey of the site has been made, consisting of both soundings and borings, and detailed plans for the structure are being prepared. This project was temporarily suspended during the year, preference having been given to the urgent work of repairing the considerable amount of damage in the district resulting from the hurricane of September 21, 1938.

Narragansett Bay, R. I.—Hurricane repairs to a number of light stations in the vicinity of Narragansett Bay are well under way. In addition to completed work listed elsewhere in this report, work was started at Beavertail, Warwick, Prudence Island, Rose Island, Plum Beach, Dutch Island, and Sabin Point Light Stations and is scheduled for early completion. Cost to June 30 was $20,004.19.

Connecticut River, Conn.—Land was purchased and construction started on the establishment of a lighted aid and on a new base for servicing the lights and buoys on the Connecticut River. Work contracted for included driving a steel-pile bulkhead along the river front, building concrete retaining walls, and grading the land to raise the level above flood stage. Cost to June 30, $27,642.55.

Long Island Sound and vicinity.—In addition to the completed projects listed under hurricane damage in this locality, repair work has been started and is progressing steadily at a number of stations, including Block Island Southeast, Block Island Breakwater, Latimer Reef, Orient Point, and Southwest Ledge. Cost to June 30, $28,282.58.

Chesapeake and Delaware Canal, Del. and Md.—See annual report 1938, page 133. This project which was necessitated by the War Department project for deepening and widening the canal proper, included the establishment of range lights, minor lights, lighted and unlighted buoys, and several new minor fog signals. The project is 99 percent completed. Cost to June 30, $158,533.53.

Intracoastal Waterway, Va., Md., and N. C.—Studies were begun for determining bottom conditions, type of structure, etc., for a number of new aids to mark better the various newly improved channels in this portion of the Intracoastal Waterway. The illuminating equipment for these aids was ordered. When completed it is estimated the cost will be $65,955. Cost to June 30, none.

Lazaretto Depot, Baltimore, Md.—Plans and specifications were prepared for improving this depot. The work contemplated includes constructing a new garage, converting the present storehouse into an office building, razing all obsolete and unused structures, and building new concrete roads and pavements to increase buoy storage space. The project is to cost $13,500. Cost to June 30, none.

Egmont Channel, Fla.—This project contemplates the erection of two range lights and the purchase of 12 buoys. The iron structures for the lights were built and the contract for the work of erecting them has been awarded. All 12 buoys were purchased. Cost to June 30, $10,005.

Florida Reefs, Fla.—See annual report 1938, page 134. Five temporary beacons on various Florida reefs are to be replaced with permanent structures. The structures have all been fabricated and are ready to be installed when favorable weather at these exposed sites will permit. Cost to June 30, $27,462.71.

Tampa Bay, Fla.—Six iron structures were purchased for replacing six old wooden light structures and the work of erecting the lights was contracted for. Two new lighted buoys and three unlighted buoys were established. Cost to June 30, $28,426.86.

Sabine-Neches Waterway, Tex.—See annual report 1938, page 134. Further work was done during the year on the Sabine Pass-Port Arthur Canal and Sabine-Neches Canal sections of this waterway, 24 additional automatic lights on fixed structures being established to mark this waterway. Thirty-eight lights and two lighted buoys were previously established in the Neches River, south of Beaumont, the total project comprising 62 automatic lights on fixed structures and 3 lighted buoys. The work is completed except for the placing of 1 lighted buoy. Cost to June 30, $26,949.36.

Sabine Pass, La.—Two new generators were installed at the light station, the power output of the radiobeacon transmitters was increased and a new vertical radiator was erected. A new lighted bell buoy was purchased to mark the approach to the Pass. Cost to June 30, $11,157.96.

Various channels.—This project calls for the establishment of a number of new aids to navigation in many important channels and harbors on the Gulf coast, including Carrabelle Harbor and St. Joseph Bay, Fla., Calcasieu Pass, La., and Sabine River, Tex. A portion of the illuminating apparatus and some buoys were purchased. Of the total of $77,255 to be spent, $11,103 was obligated by June 30.

Intracoastal Waterway, La.—An allotment of $10,000 was provided for aids to navigation to mark newly completed sections of the waterway. Four automatic lights on fixed structures were established at Barataria Pass, Caminade Pass, and Caillou Boca, La. The erection of 32 day beacons and 2 oil post lantern lights is underway in Lavaca Bay. Approximately 75 percent of the project was completed. Total cost to June 30, $5,991.61.

Sand Island Light Station, Ala.—An allotment of $10,500 was made for installing additional riprap protection around Sand Island Light Station. Work was about 20 percent completed on June 30.

San Juan Harbor, P. R.—San Juan Harbor Range Front Light was repaired, Anegado Shoal Light was removed, and a site was prepared for the relocation of San Juan Harbor Range Rear Light. Several new lighted buoys were purchased. Cost to June 30, $11,910.10.

Mississippi River and tributaries.—Additional aids were established, being required because of the canalization of this section of the river between St. Louis and St. Paul. About 100 third-class special buoys, twenty-five 200 mm. and sixty 90 mm. battery flashing lights have been purchased and installed, and 120 additional buoys and moorings have been obtained and are ready for installation. Ten lighted buoys have been ordered but are not yet installed. Cost to June 30, $25,108.

Ohio River section.—Work on the construction of several subbases for servicing the aids in the Ohio River is under way. At Point Pleasant, W. Va., the property at Old Lock 11 was obtained by transfer. One dwelling has been placed in good condition and another is to be similarly rehabilitated for the two light attendants. A 52-foot Diesel buoy boat has recently been delivered. Plans have been made for other improvements, storage tanks and pumps for fuel oil and gasoline, construction of a boat landing, etc., and contract has been awarded for a landing barge. At Pittsburgh a site was obtained by transfer from the War Department and the grounds and the buildings were repaired. Another base is to be built for a third portion of the river at a yet undetermined site and the 52-foot Diesel motor vessel for it was purchased. Total cost to June 30, $55,961.43.

Missouri River aids, Kansas City to Sioux City.—Allotments totaling $10,500 have been made for marking the Missouri River from Kansas City to Sioux City for daylight navigation. Buoys, anchors, moorings, and daymarks have been installed by lighthouse tenders between Kansas City and Omaha. Cost to June 30, $10,500.

Tennessee River.—The sum of $22,000 has been allotted to continue the work which has been in progress under P. W. A. allotments for the marking of the channels in this river. Fifty third-class special buoys and 20 minor electric lanterns have been requisitioned. Cost to June 30, $2,818.01.

Alaska.—Work on several projects for establishing minor lights in Alaskan waters, for which total allotments of $54,000 had been made, was continued with the establishment of eight new automatic lights, the conversion of three lights to automatic-operated, the establishment of three new lighted buoys, and the purchase of apparatus for future improvement. Cost to June 30, $48,404.14.

Scotch Cap, Alaska.—Allotments totaling $80,000 were made for the rebuilding of the Scotch Cap Light Station. A camp was established and excavation of the basement was completed during the summer of 1938. Work was discontinued during the winter months and was resumed with a full crew in the spring of 1939. All necessary building material has been landed, a concrete sea wall constructed, main building foundations excavated, and concrete poured up to and including the basement floor. It is anticipated that the work will be completed in the 1940 calendar year from a subsequent allotment of $70,000 made available later in fiscal year 1939. Cost to June 30, $67,766.72.

Columbia River, Umpqua River, and Yaquina Bay, Oreg.—Allotments totaling $45,060 provide for the establishment of a number of lighted buoys, unlighted buoys, range lights, and minor lights to mark several new channels and to mark better present channels. Some equipment has already been purchased and plans are being prepared for erecting the fixed structures. Cost to June 30, $1,052.

Washington.—Remote-control equipment and fog-signal apparatus are being installed at Point Defiance and Johnson Point Lights in Puget Sound and a new automatic light and fog-signal station was established at Point Glover. Cost to June 30, $13,983.75.

California.—Improvements and replacements were made in the fog-signal apparatus at Piedras Blancas, Long Beach Breakwater, Los Angeles Harbor, and Points Bluff and Stuart Lights. Equipment purchased included Diesel-engine-driven air compressors, control equipment, electric sirens, and electric generators. Work is well under way, the cost to June 30 being $12,962.17.

Point Arguello, Calif.—Progress was made toward the establishment of a radiobeacon at Point Arguello Light Station. A tower radiator for the radiobeacon was erected, radio transmitters purchased, and plans and specifications prepared for a new radiobeacon and machinery building. Designs for a new tower and fog-signal structure were begun. Cost to June 30, $10,880.94.

Humboldt Bay, Calif., and various other harbors.—A number of aids are to be established to mark channels dredged or improved by the United States Engineers in 1939 along the California coast. One light was relocated, two lighted buoys established, and the light equipment and buoys purchased for the remainder of the project. Cost to June 30, $8,340.79.

IMPORTANT WORKS COMPLETED

Maine.—Lubec Channel, Rockland Breakwater, and the Cuckolds Light Stations were electrified and new machinery installed, including oil-engine-driven generators, storage batteries, air compressors, and light and fog signal

equipment. Cost for all three stations was $10,001.66. Similar work is planned for Whaleback Light Station. All equipment was purchased at a cost of $7,432.82 and will be installed about August 25, the period of least fog for that locality.

Cape Cod Canal, Mass.—See annual report 1938, page 132. This project was completed during the year 1939 by grading and seeding the grounds about the radiobeacon and signal control house. Total cost, $40,998.76.

Narragansett Bay, R. I.—The various lighthouses in and around Narragansett Bay suffered considerable damage in the hurricane of last September. The work of restoring them to their former state of usefulness and at the same time incorporating a number of desirable changes was completed at the following of the more important and more severely damaged stations: Gull Rocks, Conimicut, Bulloch Point, Bristol Depot, and Musselbed Shoals. Cost, $16,437.79.

Long Island, N. Y.—See annual report 1938, page 133. A number of lights and unlighted buoys were purchased and established in inlets and in main inland waterways, south side of Long Island, N. Y., to provide for night navigation and to increase the safety of day navigation. A 45-foot buoy boat was purchased for the servicing of these aids. Total cost, $39,652.59. Further work will be necessary as the improvement of channels by the War Department proceeds.

Long Island Sound and vicinity.—The work of repairing the extensive damage due to the September hurricane was progressively carried on and was completed at Falkner Island and Montauk Point Light Stations and New London Depot at a cost of $12,841.49.

Little Gull Island, N. Y.—Considerable repairs necessitated by the hurricane of September 21, 1938, were made at Little Gull Island Light Station. About 2,500 tons of riprap were installed forming a breakwater to protect the pier, fog signal house, and south side of the island. A new boat railway was erected and equipment for handling the boats installed. The concrete deck and stone cap of the pier were renewed and improvements were made to the interior of the building. Cost, $33,948.22.

Watch Hill, R. I.—In addition to making repairs to the keepers' dwelling, tower, and storehouse, damaged in the hurricane of September 21, 1938, at Watch Hill Light Station, this project consisted of the construction of a concrete sea wall, concrete underpinning for the engine house, and a garage. Total cost, $14,952.22.

Hudson River, N. Y.—See annual report 1938, page 133. Two automatically operated acetylene lights were established in Haverstraw Bay, electric range lights were established at Silver Point and Tarrytown Channels, while at Kingston Flats the lighted buoy was replaced by an automatic light built on a sheet-steel pile foundation. Cost, $38,145.20.

Maryland and Virginia.—New machinery and fog signal equipment was purchased and installed at Smith Point, Wolf Trap, and Old Plantation Flats Light Stations, Va., and at Point No Point Light Station, Md., at a cost of $13,075.55.

Intracoastal Waterway, S. C., Ga., and Fla.—See annual report 1938, page 133. Work on this project was completed, 79 new lights and 35 beacons having been established. Material was purchased for the establishment of future aids that will be required as new channels are completed by the U. S. Engineers. Cost, $67,604.09.

Charleston, S. C.—See annual report 1938, page 133. A cylindrical cofferdam 60 feet in diameter consisting of 30-foot steel-sheet piles was driven around the foundation of Charleston Light Station. The piles were driven to an elevation of about 9 feet above the sand beach and the cylinder was filled with sand and capped with an 18-inch-thick concrete slab. Work was completed November 17, 1938. Cost, $13,311.85.

Miami, Fla. Entrance Channel.—A new iron light structure for Miami Entrance Range Front Light was erected, all work having been completed September 1938. Total cost, $24,497.21.

Port Everglades, Fla.—See annual report 1938, page 134. This project consisted of installing four 3-pile iron light structures, two single-pile iron light structures, and moving two range lights to new sites. All work was completed April 1939. Total cost, $18,898.97.

Intracoastal Waterway, Ala., Miss., and La.—See annual report 1938, page 134. Further work was done during the year in Mud Lake, La., 5 additional automatic lights on fixed structures being established to mark this waterway.

The entire project is now completed, comprising 16 automatic lights and 24 day beacons. Cost, $9,866.55.

Gulf coast.—New radiobeacons were established at Cape San Blas, Fla., and at Brazos-Santiago, Tex., and a transmitter, antenna, and other equipment were installed at Galveston Jetty Light Station, at a total cost of $19,018.43.

Mona Island, Puerto Rico.—See annual report 1938, page 134. This light station was electrified and a radiobeacon was put in operation on October 1, 1938. Power is furnished by two 2-kilowatt gasoline-operated electric plants in conjunction with a wind electric generator. Cost, $10,326.41.

Missouri River.—See annual report 1938, page 135. The marking of the section of this river from the mouth to Kansas City, covering 377 miles, has been completed. Lighting is principally by oil lens lanterns but includes 16 battery-operated flashing lights and about 1,200 unlighted buoys. Cost, $30,000.

Mississippi River.—See annual report 1938, page 135. A total of 95 battery-operated flashing lights and 60 third-class special buoys, also a number of day-marks and lightweight buoys were installed, completing this project. Cost, $23,000.

Pacific coast.—New radiobeacons were established at the light stations at Cape Hinchinbrook, Alaska, Bonita Point, Calif., and Yaquina Head, Oreg., at a total cost of $11,839.38.

Columbia River, Oreg. and Wash.—See annual report 1938, page 135. This project provided for the establishment of aids to navigation on the Columbia River between Bonneville and The Dalles, Oreg., and from Celilo, Oreg., to Wallula, Wash., including all necessary lights, buoys, and beacons. The completed cost was $22,900.

Los Angeles, Calif.—See annual report 1938, page 135. A 32-foot Navy launch was rebuilt and refitted, and a frame boathouse was built at the Los Angeles Depot. A compressed-air-operated hoist and derrick for handling the boat was provided. Cost, $9,642.67.

WORK PERFORMED UNDER ALLOTMENTS FROM THE PUBLIC WORKS ADMINISTRATION

Sheffield, Ala.—Sheffield Servicing Base was established, including the construction of a steel storage building, access road and dock, and the purchase of a new 52-foot steel buoy boat, a light truck, and miscellaneous equipment. Project is about 96 percent complete. Cost to June 30, $36,747.11.

Mobile, Ala.—The work done under this project at the lighthouse depot comprised demolishing one old outer wooden-frame building, demolishing 150 feet of the outer end of wharf, constructing 315 feet of wharf structure 75 feet wide, and dredging 6,000 cubic yards of material. Cost, $41,908.19.

Yerba Buena, Calif.—Allotments of $39,000 and $19,800 were made for developing the lighthouse depot at this point. A three-story concrete building 50 feet by 100 feet on creosote piles was erected for general storage purposes and a single-story, fireproof building 52 feet by 52 feet, was built for use as a carpenter and boat shop. Cost to June 30, $49,647.87.

Los Angeles, Calif.—A single-story concrete house, 14 feet by 32 feet, was erected on the breakwater near the light station for storage of gasoline, lubricating oil, and inflammable supplies. Cost, $4,117.71.

California.—Fog signal machinery was installed at six important light stations, in all cases electrically driven units being provided. In some cases commercial power was available, in others Diesel-engine-driven generators for supplying the electricity were included in the new equipment. Cost to June 30, $35,582.62.

New London, Conn.—From an allotment of $30,000 the foundation of New London Ledge Light Station was repaired and strengthened. Work which had been halted by the hurricane in the fall of 1938 was continued in the spring. A sheet-steel pile cofferdam was built, completely encircling the base, and the space between the old base and the steel piling was filled with concrete. Work was about 98 percent completed on June 30, at a cost of $26,159.41.

Bartlett Reef, Conn.—An automatically operated acetylene light was established near the site of the former Bartlett Reef Lightship. The light, consisting of a standard 18-foot skeleton steel tower built on a riprap foundation, was completed at a cost of $12,930.10.

Harbor of Refuge, Del.—This project for protecting the light station, for which $20,000 has been allotted, consists of placing riprap and concrete reinforcing

around the lighthouse and constructing a concrete sea wall. The project is 65 percent completed, the cost to June 30 being $13,035.83.

St. Johns River, Fla.—This project contemplates the improvement of 51 minor lights. Lanterns, flashers, and other equipment were purchased and are ready for installation. Cost to June 30, $14,300.

Key West, Fla.—An allotment of $11,800 was made for making repairs and improvements to buildings, wharves, and grounds recently acquired from the Navy Department to make them suitable for use as a lighthouse depot and to obtain needed equipment. Defective piles in the wooden wharf were replaced by creosoted piles with cement sand mortar casings; a transformer, an underground cable, electric wiring, and standards were installed; power tools for the carpenter shop, a concrete mixer, and 10,000 board feet of treated ceiling were purchased; and the roofs of the buildings were painted. Cost, $11,758.63.

Charlotte Harbor, Fla.—Three iron structures are to replace three wooden structures on exposed sites, the main light is to be transferred to a taller structure, and seven lights are to be electrified. The iron structures, two electric engine generators, 28 battery cells, and some of the electric illuminating apparatus were purchased. The iron structures were to be erected by contract, but as no bids were received in response to first advertisement and circular letters, proposals have been reinvited. Cost to June 30, $18,972.71.

Portland, Maine.—A fireproof steel building, 120 feet by 40 feet, was erected at the lighthouse depot for storage purposes, and a solid concrete wall about 180 feet long was built to retain the bank at the rear of the property. About 10,500 square yards of the wharf was given a bituminous pavement, thus affording much-needed buoy storage space. Cost, $12,983.80.

Maine.—Fog signal equipment was installed at Egg Rock, Moose Peak, and Petit Manan Light Stations to replace worn-out and obsolete equipment. Included in the apparatus were oil-engine-driven electric generators, batteries, electrically driven air compressors, and Duplex diaphragm fog horns. In addition, all buildings were electrified. In each case the better of the old fog signal engines was reconditioned and retained in service as a standby. Cost, $12,681.08.

West Penobscot Bay, Maine.—The Graves Light, an unattended automatically operated acetylene aid, was established on a dangerous reef about 2 miles southeast from Camden. The foundation is of reinforced concrete anchored to the granite ledge and is surmounted by a skeleton steel tower bearing the lighting equipment. Cost, $6,551.38.

Southwest Harbor, Maine.—A wharf was built, consisting of a granite wall 15 feet high from low water line to deck level enclosing the old wharf and providing a total available docking space of 359 lineal feet and giving a deck area of about 55,000 square feet for buoy storage. Cost, $51,478.69.

Point Lookout, Md.—A 12-foot channel to the light station was dredged by the removal of about 1,500 cubic yards of material, and a sheet-steel pile bulkhead, 500 feet long, was erected. Sheet pile jetties at about 65-foot intervals, reinforced with riprap, were built out on the Chesapeake Bay side of the bulkhead. Cost, $9,778.99.

Craighill Channel Range Rear Light, Md.—The keeper's dwelling at the base of the light tower was razed, the wooden structural members at the base of the tower were replaced with steel members, a reinforced concrete deck was placed on the top of the foundation piers, and concrete-filled steel caissons were placed around the nine foundation piers to prevent further deterioration. Cost to June 30, $8,903.13.

Baltimore, Md.—A brick-and-concrete building to house the depot keeper's office and the Lighthouse Service radio laboratory was constructed within the grounds of the Lazaretto Lighthouse Depot. A 1-ton electric hoist was installed in the elevator shaft of the main storehouse and a mobile crane-car for shifting heavy equipment about the depot was purchased. Cost to June 30, $19,649.47.

Lynn Harbor, Mass.—Four cylindrical sheet-steel pile caissons of 12-foot diameter were built as foundations for four automatic lights. The caissons were filled with rock, capped with concrete, and skeleton steel towers from nearby abandoned structures moved to them. Riprap was placed in a protecting sheet around the base of each caisson. Cost, $10,450.64.

Hog Island Channel, Mass.—Two cylindrical sheet-steel caissons were built to take the place of those of lights Nos. 8 and 10 which had previously been destroyed. The caissons were built with a diameter of 12 feet, with greater penetration than the previous structures and with riprap around the base as a

protection against scouring. Automatic acetylene lighting apparatus on 18-foot skeleton steel towers was installed. Cost, $13,399.45.

Chelsea, Mass.—Extensive repairs to the lighthouse depot were made under this project. Sunken and defective portions of the existing concrete paving in the depot yard were removed and replaced with new reinforced paving 8 inches thick. Areas of sunken fill were restored to grade. That portion of the yard which was unpaved was graded and paved in a similar manner. The entire depot yard is now surfaced with reinforced concrete, thus providing storage space for chain, buoys, sinkers, etc. Both slips and the entire face of the wharf were dredged to 18 feet below mean low water. Cost, $16,403.24.

Edgartown, Mass.—The former frame structure at Edgartown Light Station was razed to its stone pier and replaced with a conical cast-iron tower. The light was electrified by commercial current with an engine generator standby and was made unattended. Control for the light is by a time switch while the bell is controlled from shore by a part-time attendant. Cost, $4,936.

Plymouth Harbor, Mass.—Steel-sheet pile caissons similar to those used at Lynn Harbor were driven in the sand bottom, and wooden skeleton towers with automatic acetylene lights were placed on the caissons, to mark two abrupt turns in the narrow channel leading to Plymouth Harbor. Cost, $5,348.93.

Whitefish Point, Mich.—The keeper's dwelling at this station was moved and repaired and an improvement in the water supply system was completed during the year at a cost of $6,966.

Manitou Island, Mich.—A radio and fog signal building was substantially completed at this station during the year together with water-supply and sewage-disposal systems. Installation of fog signal equipment is under way and scheduled for early completion during the first half of the coming fiscal year. Cost to June 30, $30,940.

Sault Ste. Marie, Mich.—Oil storage facilities and an addition to the present wharf were completed during the year while a contract was let and work started for a new office building at this depot. Cost to June 30, $39,454.

Gravelly Shoal, Mich.—A contract was let for the foundation and structure for the new light station and the foundation was about 50 percent completed. Shore improvements were made to assist in monitoring this station. A boat was built and bids have been received on a dock and boathouse. Cost to June 30, $100,596.

Lake St. Clair, Mich.—Work is under way on a light, radio, and fog signal station in Lake St. Clair to be controlled from a shore light station. At the close of the year the foundation was about 95 percent completed and a contract was in force for the superstructure. Cost to June 30, $70,220.

Escanaba, Mich.—A remote-controlled light was erected on a submarine site. It consists of a rectangular enclosed steel tower on a cylindrical sheet-steel pile caisson, housing both the fog signal apparatus and lighting equipment. The keeper's dwelling on shore remains to be remodeled. Cost to June 30, $21.438.16.

Mission Point, Mich.—An automatic light on a submarine site was established in place of a lighted buoy. The structure consists of a skeleton steel tower on a cylindrical steel-sheet pile pier. The tower is enclosed at the base to provide a shelter for housing the storage batteries operating the light. Cost, $14.998 53.

St. Clair Flats, Mich.—Bids were accepted and the work is under way on a dwelling for the assistant keeper at this light station. Cost to June 30, $7,914.

Omaha, Nebr.—A site was obtained and a steel storage building, a 1½-ton truck, and miscellaneous equipment were purchased for the establishment of Omaha Servicing Base. The actual development of the site was not started. Cost to June 30, $786.81.

Staten Island, N. Y.—Elm Tree Light Station was completely rebuilt, the old wooden tower being replaced by a reinforced concrete tower of modern design. Cost to June 30, $4,716.27.

Hempstead Harbor, N. Y.—Bar Beach Light was established. This light is an unattended acetylene-operated light on a skeleton steel tower, the foundation being a cylindrical sheet-steel pile caisson reinforced with riprap. Cost, $8,042 30.

Hudson River, N. Y.—Under this project, for which $41,457.70 has been allotted, a new base for servicing the lights and buoys in the upper portion

of the Hudson River is being built at Turkey Point, N. Y. A 200-foot section of the river front was developed by a sheet-steel pile bulkhead and concrete pavement, a contract for a storehouse was let, and plans and specifications were prepared for a roadway to the base. Cost to June 30, $26,440.60.

Sodus, N. Y.—The pierhead tower was rebuilt, lights were electrified, an air diaphragm-type fog signal was installed, and a brick control house was constructed on shore with standby generator and submarine cable to light. Cost, $11,571.49.

Toledo, Ohio.—This project consists of improvements of a site located in Toledo, Ohio, for subdepot purposes. A depot building, size 38 feet by 60 feet, with office space, has been completed. Other completed work includes dredging of a channel, improvement of the grounds, bulkhead work, and the purchase of a 45-foot steel patrol boat to be delivered about August 1, 1939. The work remaining consists of improvements of the grounds and erection of a fence. Cost to June 30, $60,142.08.

Columbia River, Oreg.—For better marking the section of the river from Celilo to Wallula a number of aids were established, including several special shallow-draft-type buoys, 3 minor lights, and 4 sets of range lights. In addition, 17 special-type buoys were established by contract. Cost, $8,000.

Cape Arago, Oreg.—The old steel foot bridge leading to the light station from the mainland was demolished and a new bridge was constructed on the old foundations. Cost, $6,748.66.

Tongue Point, Oreg.—This project provides for the construction of sheet-steel pile bulkhead with anchorage system, hydraulic fill of area approximately 200 feet by 200 feet and construction of storage warehouse, machine shop, and blacksmith shop. Construction of bulkhead and fill was completed and plans for the warehouse, machine shop, and blacksmith shop developed. Cost to June 30, $55,859.75.

Erie Harbor, Pa.—A storage building was erected on a concrete slab alongside the north pier at Presque Isle for housing spare buoy equipment. Cost, $4,791.04.

Bordcn Flats, R. I.—This light station was of the cast-iron caisson type. The structure had developed a slight list and its base sections were badly cracked. A steel-sheet piling caisson having a radius 10 feet greater than the cast-iron pier was driven, filled, and capped. thus not only affording greater protection but providing much-needed increase in deck space as well as two concrete pit-type storage bins beneath the deck. Cost, $13,521.51.

Portsmouth, Va.—Under this project a considerable amount of repair work was done at the Portsmouth depot. The main storehouse roof was resurfaced and a new roof was built over the buoy shed. In the main storehouse the walls were replastered and a new wood-block floor was laid. A brick wall about 8 feet high and 360 feet long was built on the south and east boundaries of the reservation, while a 60-foot long by 20-foot deep garage was erected. Cost, $11 941.41.

Cape Henry, Va.—A six-room, brick-veneer, frame dwelling, measuring 26 feet by 26 feet in size, was constructed at Cape Henry Light Station. The existing dwellings were remodeled and the fog-signal laboratory was reroofed. A concrete ramp and driveway was constructed adjacent to the fog-signal laboratory to facilitate moving test equipment and the damaged and overloaded crane on the fog-signal test tower was restored to a serviceable condition. Cost, $12,968.15.

Sherwood Point, Wis.—The light station was electrified, the fog signal was improved, and a radio beacon was established, while a one-story addition was made to the fog-signal house for accommodating the additional equipment. Cost to June 30, $4,062.77.

La Pointe, Wis.—A new three-family dwelling for La Pointe Light Station was completed during the year and work started on water-supply and sewage-disposal systems and dock. Cost to June 30, $16,662.

BUREAU OF FISHERIES

Available statistics indicate that there was a decrease in the volume but an increase in the value of fishery products taken in the United States and Alaska during 1937 as compared with the preceding year. Data on the catch were collected for both 1936 and 1937 in the Chesapeake, South Atlantic and Gulf, Pacific, and Lake States and in Alaska. The combined catch in these sections alone shows a decrease of 13 percent in volume but an increase of 7 percent in value. Decreased catches were made in each of the five geographical sections; however, the principal reductions occurred in the Pacific Coast States where greatly reduced catches of pilchards were taken, and in Alaska where there was a large decline in the catch of salmon.

The total catch of fishery products in the United States and Alaska, as based on the most recent surveys, amounted to 4,352,549,000 pounds, valued at $100,845,000. About 130,000 fishermen were employed in making this catch.

The production of canned fishery products in the United States and Alaska during 1937 amounted to 742,197,000 pounds, valued at $105,175,000; the output of byproducts was valued at $36,804,000; the production of frozen fishery products, excluding packaged products, amounted to 103,112,000 pounds, estimated to be valued at $8,800,000; and fresh and frozen packaged fish and shellfish, 201,803,000 pounds, valued at $27,678,000. Based on surveys for previous years, the production of cured fishery products amounted to 104,339,000 pounds, valued at $15,635,000. It is estimated that about 686,000,000 pounds of fresh fishery products (excluding packaged fish and shellfish), valued at about $57,000,000, was marketed during 1937. The total marketed value to domestic primary handlers of all fishery products in 1937 is estimated at $251,000,000.

Fishery products imported for consumption were valued at $50,636,000 and domestic exports were valued at $14,567,000.

The value of the production of canned fishery products in all sections increased 11 percent as compared with 1936; byproducts increased 5 percent; frozen fish, about 1 percent; and packaged fish, 3 percent.

INTERNATIONAL RELATIONS

HALIBUT INVESTIGATIONS

The International Fisheries Commission continued the investigation and regulation of the Pacific halibut fishery, under authority of the treaty of Jauary 29, 1937, between the United States and Canada.

In fulfillment of its regulatory duties, the Commission recorded the catch from each regulatory area, forecast and announced the date

of attainment of each area limit, and closed the areas accordingly. It opened the 1939 fishing season on April 1 under regulations essentially unchanged from those of the preceding year.

Areas 1 and 2 were closed to halibut fishing in 1938 at midnight of July 29, with catches of approximately 706,000 and 22,923,000 pounds, respectively. Areas 3 and 4 were closed at midnight of October 29, with catches of 25,591,000 and 0 pounds, respectively.

The investigations of the Commission's scientific staff were continued along the lines necessary for fulfillment of the purpose of the treaty. Current biological and statistical data, which form a system of observation of the changes occurring in the stocks of halibut as a result of regulation and a necessary basis for the continued rational control of the fishery, were collected and analyzed. The collection of biological data made necessary the operation of a vessel at sea.

The abundance of halibut, as indicated by the catch per unit of fishing effort, showed a further increase all along the coast in 1938. In area 2, between Cape Spencer in Alaska and Willipa Bay in Washington, the abundance was 15 percent greater than in 1937, 100 percent greater than in 1930. In area 3, between Cape Spencer and the Aleutian Islands, it was 3.5 percent greater than the previous year and 77 percent greater than in 1930, the last year of unrestricted fishing.

Sampling of the stocks of marketable halibut by means of market measurements was continued to determine the changes occurring in their composition as a result of regulation. For the first time since the Commission began regulating the fishery, market measurements failed to show an increase in the size of the fish landed or in the proportion of mature fish on the more depleted banks of area 2. The maximum proportion of larger sizes from the stock of young available at the time regulation began appears to have been reached and a further increase in the larger sizes may not occur until the increasing stock of young has had time to grow up.

Observation of the effect of regulation on the production of spawn in area 2 was continued by means of net hauls taken at sea during the winter spawning season. Analysis of the catches of eggs indicated that the increase observed in their abundance from 1934–35 to 1936–37 was not continued in 1937–38 and 1938–39. No special significance can yet be attributed to the failure of production in the latter 2 years to equal the high level of 1936–37, because of the variations that occur normally from year to year among marine species, but it is to be suspected that it may be associated with the changes in size composition mentioned above.

INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION

Work of an experimental and preliminary nature, to establish facts upon which the permanent program could be based, was carried on during the 1938 season. A compilation and analysis of the great mass of existing records of the sockeye run to the Fraser River was nearing completion by the end of the year. A survey of the spawning grounds was begun. The adult migrants in salt water were tagged and extensive recoveries made on the spawning grounds.

The Commission held its third meeting September 23–24 in Vancouver, B. C. The program of investigation, then under way, was discussed and that for 1939 approved. In February 1939, William A. Found resigned and was replaced by A. J. Whitmore.

JAPANESE ACTIVITIES IN THE BRISTOL BAY FISHERY

Japanese fishery operations in Bristol Bay in 1939, the tenth consecutive season in which such activities have been carried on, were confined to the catching and canning of king or spider crabs, and only one floating cannery, together with auxiliary craft, was employed. This indicates a continued adherence on the part of the Japanese Government to the assurance given in the spring of 1938 that its official survey of the salmon in Bristol Bay would be suspended and that it would issue no license to vessels to take salmon in those waters.

CONSERVATION OF WHALES

The Protocol of June 24, 1938, which amends in certain particulars the International Agreement for the Regulation of Whaling, signed at London on June 8, 1937, came into force as to the United States on March 30, 1939, and was proclaimed by the President on April 8, 1939.

The principal provisions of the Protocol of 1938, which are advances in the measures of conservation of the whale stock of the world provided in the agreement of 1937, are as follows:

(1) A prohibition against the taking or treating of humpback whales south of 40° south latitude by factory ships or whale catchers attached thereto from October 1, 1938, to September 30, 1939. (Article 1.)

(2) The establishment of a sanctuary for baleen whales south of 40° south latitude between 70° west longitude and 160° west longitude for a period of 2 years from December 3, 1938. (Article 2.)

(3) A clarification of provisions in articles 7 and 8 of the agreement of 1937, which had given rise to conflicting interpretations, so as to make clear that no factory ship which has been used for the purpose of treating baleen whales south of 40° south latitude shall be used for that purpose elsewhere within 12 months from the end of the open season; that only factory ships which have operated within the territorial waters in 1937 shall so operate after the signature of the protocol; that such ships shall be treated as land stations, shall remain moored, and shall not operate more than 6 months in any 12-month period; and that such operations shall be continuous. (Article 3.)

NORTH AMERICAN COUNCIL ON FISHERY INVESTIGATIONS

The twenty-fifth meeting of the North American Council on Fishery Investigations was held in Boston, Mass., October 4–7, 1938. Representatives from Canada, Newfoundland, and the United States were present. At the invitation of the Council, members of the Fishery Advisory Committee of the Department of Commerce and other leaders of the fishing industry attended a general session on

October 5 for a discussion of fishery problems in the North Atlantic area. The general program of fishery investigations being conducted by Canada, Newfoundland, and the United States was presented.

In the sectional committee meetings dealing with groundfish investigations, shorefish studies, hydrographic research, and fishery statistics, nearly a score of investigators presented reports on their work, affording members of the Council a summary review of progress during the year in these fields and permitting them to modify their official program accordingly. Important advances were reported in the study of the cod fishery being prosecuted by Canada, the lobster studies in Newfoundland, and the investigations in the United States leading to a proposal for effective management of the haddock fishery.

INTERSTATE COOPERATION IN FISHERY MANAGEMENT

As a result of efforts of the Council of State Governments in cooperation with the Bureau of Fisheries and with fishery administrators of the various States concerned, progress has been made toward the solution of fishery problems in the Great Lakes and on the Atlantic coast.

The Interstate Committee on Great Lakes Fisheries, appointed at the conference held under the auspices of the Council of State Governments in February 1938, met in Chicago on December 5. An international treaty to bring about uniform regulation of Great Lakes fisheries was again endorsed. Pending the adoption of an international treaty, however, the Committee recommended the adoption of an interstate compact for the regulation of United States fisheries in the Great Lakes. The formation of such a compact has been authorized by the Congress of the United States. The Committee also urged that State fish and game commissioners be given discretionary power to regulate fisheries without legislative action.

At the Eastern States Conservation Conference held in New York November 19, a resolution was unanimously adopted petitioning Congress to grant permission to States bordering on the Atlantic coast to enter into a compact for the protection of migratory fishes in territorial waters. A committee was appointed to prepare a draft of the compact for submission to the States.

FISHERY ADVISORY COMMITTEE

The Fishery Advisory Committee met in Boston, Mass., on October 5, 1938, in conjunction with the National Fisheries Convention in session during the week. Discussion centered largely around problems of production and merchandizing fishery products. On October 5, members also attended a general session of the North American Council on Fishery Investigations for consideration of fishery problems in the North Atlantic area.

The Committee met in Washington, D. C., January 30–31, 1939. Special problems challenging the industry at this time, recommended by the Committee for further research, are improvements in methods of transporting iced and frozen fishes and more complete utilization of the waste products of the fisheries. Inasmuch as fishery products constitute a wholesome and nutritious food which contains mineral

elements essential to health that are not readily available in many foods of land origin, an even flow of fishery products from producer to consumer is essential to the public interest.

DOMESTIC RELATIONS

COOPERATION WITH FEDERAL, STATE, AND OTHER AGENCIES

Cooperation was given by members of the Bureau technological staff to chemists and bacteriologists of the Food and Drug Administration, U. S. Department of Agriculture, in connection with the development and application of tests on methods of determining the quality and constituents of various fishery products; and to the Extension Service of the U. S. Department of Agriculture in connection with the conduct of demonstrations and practical instruction on the preservation of fishery products and more complete utilization in the diet of the excellent food value of fish and shellfish.

Members of the economic and marketing staff of the Division of Fishery Industries cooperated with the Department of Labor in holding conferences with fishermen's unions and associations to settle disputes. The Division also worked with various Federal agencies in obtaining statistical data on our fisheries. These included the Bureau of Agricultural Economics, the health authorities in Washington, D. C., and the Bureau of the Census.

The Bureau has carried on cooperative investigations in technological work with several colleges, universities, and other State institutions. Outstanding among these are Washington State College, Pullman, Wash.; University of Washington, Seattle, Wash.; University of Maryland and Maryland State Agricultural Experiment Station, College Park, Md.

In the conduct of its statistical and marketing work some form of cooperation is given the Bureau in virtually every State where commercial fishing is prosecuted. This cooperation probably reached its greatest development in the States bordering on the Great Lakes and in the Pacific Coast and Chesapeake Bay States.

The Division of Fish Culture maintains the closest liaison with the State fish and game departments and other Federal agencies concerned with the conservation of fish. There has been close contact between the Bureau's representatives, the Bureau of Reclamation, and fisheries officials of the State of Washington with reference to the development of plans for the artificial propagation of the salmon run to be affected by the completion of the huge Grand Coulee Dam.

There has been continued expansion of the policy of routing fish applications to the State departments for check and approval before deliveries are made. The natural consequence of this has been a development of arrangements for the States to deliver the fish with their own equipment and this has been practiced in a number of instances.

The exchange of eggs and fish by the Bureau has been of mutual benefit, particularly in Michigan and Minnesota. In the Western States also, particularly in Oregon, the fish-cultural and fish-distribution work is closely coordinated, with resultant economies to both the State and the Federal Governments.

In the Tennessee Valley area, three-way agreements between the Bureau of Fisheries, the Tennessee Valley Authority, and the States of Alabama, Tennessee, and North Carolina have been made effective or are being negotiated. Under such agreements the T. V. A. has established and built hatcheries and rearing facilities which the Bureau is to operate. The fish produced are to be distributed by the States in that part of the Tennessee Valley area which are included within the respective State boundaries.

The work with the National Park Service has continued in a constructive way and at the close of the year the Park Service was constructing a new hatchery at Glacier Park with subsequent operations to be managed by the Bureau.

In view of the tremendous responsibility upon the Forest Service of the Department of Agriculture for the maintenance of fishing in the national forests, the Bureau has enjoyed unusual cooperation with that agency. A new trout-rearing unit was under construction in the Allegheny National Forest in Pennsylvania, under plans developed and approved by the Bureau with the expectation that it would be operated by this Bureau upon completion.

The State of North Dakota Fish and Game Department donated the site for a new hatchery at Valley City. At St. Louis, Mo., the city officials have approved the construction, at no cost to the Bureau, of a modern hatchery and service building in the Forest Park hatchery. This series of ponds was taken over by the Bureau for operation shortly before the start of the fiscal year 1939 and the results have been most favorable. The State of Minnesota donated a tract of land for a hatchery at New London and furnished the services of surveyors and engineers in acquiring additional property. The site for a new hatchery, at Farlington, Kans., was more easily acquired by reason of the donation of water rights to a State-owned lake. The State of Ohio purchased and donated to the Bureau a splendid location for the new hatchery to be constructed in that State.

CONSTRUCTION ACTIVITIES

At the start of the fiscal year there was being undertaken an extensive program of hatchery development and improvement financed by an allocation of $808,500 from the Public Works Administration, and $500,050 from the Works Progress Administration.

These funds were allocated to more than 70 different field projects, involving complete rehabilitation of some of the older hatcheries and enlargement and improvement of the newer establishments. The work involved replacement of pipe lines or complete construction of new water-supply systems; construction, repair, and improvement of buildings; construction of ponds; installation of new equipment; and general landscaping. In some instances there was a 100-percent increase in the productive capacity of a station. The Public Works Administration funds were largely used for the purchase of materials, supplies, and equipment; while the labor, practically all from relief sources, was a contribution from the Works Progress Administration allotment.

The principal development of an entirely new nature was the construction of a pondfish hatchery at the Roy Inks Dam on the lower

Colorado River in Texas. The site was furnished by the Lower Colorado River Authority and the construction was supervised by the Bureau. It was financed by a portion of the P. W. A. allotment and by the assignment of N. Y. A. labor. At the close of the year this project was virtually completed and some of the ponds were stocked with fingerling bass.

Great improvements were effected at the Fort Worth station, where an additional tract of land was donated by the city of Fort Worth and utilized for the development of additional ponds.

The Charlevoix, Mich., hatchery, which had been closed since 1933, was entirely rehabilitated and equipped for the rearing of lake trout fingerling.

In several instances the State W. P. A. projects were in effect, also making possible additional improvements. An outstanding example of this method was at Guttenberg, Iowa, where initial work on a very large bass and pondfish hatchery within the Upper Mississippi River Wild Life and Fish Refuge was undertaken. Curtailment of the scope of the C. C. C. resulted in some restriction of the construction work prosecuted by this agency. A limited number of assignees were held at work at Lamar, Pa., but the C. C. C. development at the York Pond, N. H., station was terminated. However, it was possible to continue developments there by utilization of emergency funds allotted directly to the Bureau.

In addition to the improvements made possible by direct cash allotments to the Bureau, the Appropriation Act for 1939 carried the sum of $155,000, provided for the construction of new hatcheries in Kansas, North Dakota, Minnesota, and Ohio. A suitable site was located at Valley City, N. Dak., and, at the close of the fiscal year, the hatchery was approximately 75 percent completed, although not in readiness for operation. Sites were selected at Hebron, Ohio, Farlington, Kans., and New London, Minn., but various difficulties were encountered in acquiring clear titles to these sites, with resultant delay in starting actual construction. At the close of the year, however, preparations were being made to initiate the construction phase at each of these locations. The funds appropriated for these hatcheries were continued available during the fiscal year 1940.

By means of funds allotted from the Public Works Administration and the Works Progress Administration, improvements were also made during the year to the technological byproducts laboratory building and the chemical laboratories in Seattle, Wash.

ALASKA FISHERIES SERVICE

ADMINISTRATION OF FISHERY LAWS AND REGULATIONS

Careful observations of the runs and escapement of salmon were made in all fishing districts, and regulations were modified as seemed desirable. In general, the salmon runs were satisfactory, and most of the changes in regulations during the season were relaxations to permit additional commercial fishing in specified localities. The Commissioner of Fisheries spent several weeks in Alaska inspecting the fishery and fur-seal activities.

Revised regulations, issued on February 11, to be effective in 1939 contained few changes of major importance. The salmon fishing

season was shortened in parts of southeast and central Alaska, and in some localities the season was extended slightly, in view of the satisfactory runs. In order to promote the use of claims for outlying areas that had previously been but little exploited, the limitation on the pack for the Seward-Katalla district as a whole was increased, while a limitation was placed on the output of certain well-known beds in the district. Some additional restrictions were placed on commercial fishing for herring and crabs.

Two 15-year leases of oyster bottoms in Alaska were executed during the fiscal year 1939 under the authority granted by the act of August 2, 1937, for the protection of oyster culture in Alaska. Liberal leasing terms have been established in order to encourage the development of this industry.

Fourteen vessels of the Bureau, five speedboats, and a number of other small power boats were used in the patrol of the fishing grounds. The personnel identified with fishery-protective work numbered 209, including wardens, stream guards, weir operators, vessel crews, and biologists. Chartered airplane service was used to some extent to supplement the vessel patrol, and also for surveys of the spawning grounds and transportation of officials to isolated districts.

Attention was given to the reclaiming of former spawning areas that had become inaccessible to the salmon by reason of accumulated débris from slides and windfalls. This work was largely incidental to the patrol of the fishing grounds. The destruction of predatory trout that feed upon salmon eggs and fry was continued in the Bristol Bay and Cook Inlet regions through funds supplied by the Territory and by local salmon packers. An appropriation of $25,000 was made by the Territorial Legislature in 1939 to continue the improvement of salmon streams and the payment of bounty on predatory trout during the next 2 years.

Biological studies of the salmon and herring were continued, the work in connection with the former being extended to include a comprehensive investigation of the red-salmon fisheries of Bristol Bay. Further studies concerning the effect of predatory trout in reducing the numbers of young salmon were carried on in the Kodiak region. Weirs for counting the escapement of spawning salmon were operated in 11 representative salmon streams.

PRODUCTS OF THE FISHERIES

Notwithstanding the fact that several plants stood idle because of prolonged labor negotiations in the spring and the consequent delay in preparation for the season's operations, the volume of fishery products in Alaska compared favorably with the average for recent years. An outstanding feature was the unusual abundance of red salmon in the Bristol Bay area, resulting in the largest catch ever recorded for that region.

The total output of Alaska fishery products in 1938 was 446,664,000 pounds, valued at $42,870,000, as compared with 452,545,000 pounds, valued at $51,743,000 in 1937. The estimated value of the 1938 catch to the fishermen was approximately $12,040,000, or about $2,198,000 less than in the preceding year. There were 28,084 persons employed in the various branches of the industry, as against 30,331 in 1937.

Salmon products comprised approximately 78 percent in quantity and 91 percent in value of the total output of the Alaska fisheries in 1933. Ninety-three percent of the salmon products consisted of canned salmon, the pack amounting to 6,807,000 cases, or 326,736,000 pounds, valued at $36,637,000. Red salmon represented 37 percent and pinks 47 percent of the total pack of canned salmon, as against 32 percent and 54 percent, respectively, in 1937. As compared with the pack of the preceding year, the output of canned salmon in 1938 showed an increase of 2 percent in quantity but a decrease of nearly 18 percent in value. Ninety-eight canneries were operated, or 15 less than in 1937, and the number of persons employed in the salmon-canning industry dropped from 24,865 in 1937 to 22,280 in 1938.

Seventeen herring plants were operated, as compared with 20 in the previous year, and the quantity of herring products declined from the peak production of 1937, although continuing at a comparatively high level. Other fisheries in which there was a decreased production included the whale, shrimp, and crab industries. Only one whaling station was operated in Alaska in 1938. Halibut landings of the Alaska fleet showed a slight increase in volume, as did also cod, clam, and a few other minor fishery products.

ALASKA FUR-SEAL SERVICE

GENERAL ACTIVITIES

Sealing and foxing operations at the Pribilof Islands were carried on, as heretofore, by the natives under the supervision of a staff of 13 regular employees and a number of sealing assistants. Approximately 80 Aleutian natives also were employed during the summer in connection with sealing activities, and 23 skilled employees of the Fouke Fur Co. were at the islands for several weeks to assist in curing and packing the sealskins.

The byproducts plant on St. Paul Island was operated for the utilization of fur-seal carcasses. Products for the 1938 season amounted to 30,587 gallons of oil and 357,222 pounds of meal. These products, other than small quantities retained at the islands for fox feed, were shipped to Seattle, where the oil was sold for commercial use and the meal was transferred to the Division of Fish Culture for feeding fish at the hatcheries.

On St. George Island a warehouse and three new cottages for natives were built, and improved roads were extended about a mile. Considerable resurfacing of roads also was done there and on St. Paul Island. Four cabins and a powerhouse, as well as some new equipment, were added to the substation for sea-otter investigations and patrol in the western Aleutians.

Valuable cooperative service was rendered by the Navy Department in assibning the U. S. S. *Vega* to carry the annual shipment of supplies to the Pribilof Islands, and by the Coast Guard in patrolling waters of the North Pacific and Bering Sea for the protection of fur seals and sea otters.

Delivery of 8,755 fur-seal skins, or 15 percent of the take on the Pribilof Islands in 1938, was made to an agent of the Canadian Government at Seattle. The Japanese Government, entitled to a like

number under the provisions of the fur-seal treaty of 1911, continued the practice of sharing in the proceeds of sale, rather than taking actual delivery of the skins.

Two hundred and ten fur-seal skins taken by the Japanese Government on Robben Island in 1938 were allotted to the United States as its share under the treaty provisions and were shipped to the Department's selling agents at St. Louis, Mo., for processing and sale.

A new contract for the processing and sale of Government-owned fur-seal and other skins was entered into by the Acting Secretary of Commerce and the Fouke Fur Co., St. Louis, Mo., under date of June 9, 1939, covering sealskins taken in 1939 and the following season, and thereafter until the contract is terminated by either party.

SEAL HERD

The computed number of animals in the Pribilof Islands fur-seal herd on August 10, 1938, was 1,872,438, an increase of 33,319, or about 2 percent over the corresponding figure for the preceding year. This comparatively small increase is accounted for by the fact that it has been found necessary to apply higher mortality rates for animals in their first year at sea and to make adjustments accordingly in respect to certain age groups.

TAKE OF SEALSKINS

In the calendar year 1938 there were taken on the Pribilof Islands 58,364 fur-seal skins, of which 46,082 were from St. Paul Island and 12,282 from St. George Island. This was an increase of 3,184 over the total take in 1937. Insofar as possible, killings were confined to 3-year-old males. A suitable number of this age class was reserved for breeding stock.

SALE OF SEALSKINS

Two public auction sales of fur-seal skins were held at St. Louis in the fiscal year 1939. At the sale on October 10, 1938, there were sold 9,754 skins dyed black, 14,490 skins dyed safari brown, and 46 miscellaneous skins for a gross total of $509,293.75. On May 22, 1939, 7,800 skins dyed black and 12,720 dyed safari brown brought a gross sum of $344,338.75.

Sealskins sold at private sales under special authorization by the Secretary of Commerce consisted of 324 dyed black, 487 dyed safari brown, 1 partly processed, and 73 raw-salted skins, which brought a gross total of $17,713. In all, 45,695 fur-seal skins were sold for the account of the Government in the fiscal year 1939, for a total gross sum of $871,345.50.

FOXES

The care of blue foxes on the Pribilof Islands is an important seasonal activity, requiring attention only during the winter months when sealing operations are at a minimum. During the 1938–39 season 219 blue and 5 white foxskins were taken on St. Paul Island and 799 blue and 6 white foxskins were taken on St. George Island, a total of 1,029. Suitable reserves for breeding purposes were made

on both islands. Eight hundred and forty-seven blue and 16 white foxskins, taken on the Pribilof Islands in the 1937–38 season, were sold at public auction in the fiscal year 1939. The blue foxskins brought $16,452.50 and the white skins brought $216, a total gross sum of $16,668.50.

FUR-SEAL SKINS TAKEN BY NATIVES

The North Pacific Sealing Convention of July 7, 1911, provides that aborigines dwelling along the Pacific coast may take fur seals under restricted conditions. In 1938 Indians under the jurisdiction of the United States took 184 sealskins and Canadian Indians took 1,367 sealskins, which were duly authenticated by Government officials of the two countries.

FUR-SEAL PATROL

Vessels of the Coast Guard were again assigned by the Secretary of the Treasury to patrol waters of the North Pacific and Bering Sea for the protection of the fur seals and sea otters. One vessel of the Bureau of Fisheries also participated in the fur-seal patrol during the northward migration of the herd.

PROTECTION OF SEA OTTERS, WALRUSES, AND SEA LIONS

New regulations for the protection of walruses and sea lions were issued on June 29, 1939, extending the closed season on these animals until June 30, 1941, while continuing permission for their capture under certain specified conditions. The killing of sea otters is prohibited at all times.

PROPAGATION AND DISTRIBUTION OF FOOD AND GAME FISHES

The preliminary records of production for the hatcheries operated by the Division of Fish Culture show an output of 8,094,000,000 eggs, fry, and larger fish. With the 1938 production amounting to slightly over 8,121,000,000 it is evident that there was little variation in the scope and magnitude of the activities. Forty-six species were handled at the hatcheries and in the rescue fields. Among the individual species an increase was recorded for 16. As usual the greatest increase was shown with the commercial or semicommercial species. The Bureau initiated the propagation of Kentucky bass, which had not previously been handled at its hatcheries. No glut herring, carp, or humped-back salmon were handled at the hatcheries during the fiscal year 1939. The conduct of repair and improvement work rendered some of the fish-cultural facilities inoperative during the season with consequent curtailment of production of fish. The output of brook-trout eggs was unusually low because of the fact that a disease epidemic at the York Pond, N. H., station, the principal point of production for this species, necessitated a complete elimination of all stock on hand and reduced the distribution to negligible proportions. The production of fingerlings and large fish was 84,459,000, which presents a sharp drop in comparison with the previous year when 119,000,000 were handled. This, however, does not indicate any limitation upon the hatcheries' activities but is rather a reflection of the virtual cessation of rescue and salvage work in the Upper Missis-

sippi River Wild Life and Fish Refuge, from which source the fingerlings of warm-water species have heretofore been obtained in large numbers. The number of unfilled applications for game species as submitted by private individuals and conservation organizations was, at the close of the year, as low as at any time within recent years.

PROPAGATION OF COMMERCIAL SPECIES

The three hatcheries in New England propagating commercial species of the inshore waters were operated with increased intensity with the result that there was a noticeable increase in the production of cod, haddock, and flatfish. Pollock were produced in reduced quantities and the output of lobster fry was approximately 50 percent of the previous year's record. However, by virtue of new experimental methods the young lobsters were reared to larger size before releasing, as a means of producing greater survival. Over 5½ billion of the above-mentioned species were distributed as fertilized eggs on the spawning grounds. This is a byproduct recovery, since these eggs would otherwise be completely wasted in the marketing of the fish taken by the commercial fishermen. Propagation of mackerel was again resumed at the Woods Hole, Mass., station with an output of 11,000,000 fry. An outstanding development was the establishment by the Maine Department of Sea and Shore Fisheries of a large modern lobster-rearing unit on the grounds of the Federal hatchery at Boothbay Harbor, Maine. This establishment is operated by the State on a cooperative basis with the Bureau. There is assurance that this project will be of great significance in the future in conserving and building up the supply of lobsters, the mainstay of the inshore fisheries of the State.

Pacific salmon.—There was a worthwhile increase in the production of chinook salmon. This species is handled in two fields, the Columbia River and the Sacramento River, and the distribution was materially increased in both areas. This is especially gratifying in view of the fact that both runs have been threatened by the construction of large dams, and the 1939 figures for hatchery production indicate that there will be a satisfactory stock of salmon upon which to base future propagation activities which will serve to nullify the detrimental influences of dams. Absence of humped-back salmon in the records is merely a result of the so-called "off year" for this species. Sockeye salmon are handled in the Puget Sound area and at Quinault, Wash. At the latter point the production is deliberately curtailed so as to permit the rearing of all of the fry produced to a larger size before distribution. The salmon hatcheries also included the propagation of steelhead trout, a preeminent game fish, within the scope of their work but failed to obtain a production equal to that of the previous year.

Anadromous species, Atlantic coast.—The second year of an intensive program of rehabilitation of the shad has shown an increase in the hatchery production of this species. Over 34 million fry were planted, in comparison with 26 million in 1938. No new propagating stations were operated and the increase is a direct result of larger runs and more intensive hatchery utilization of the potential egg supply. The shad stations on the Potomac River and at Edenton, N. C., also proagated other indigenous species, including the white

perch, yellow perch, and striped bass. These are handled somewhat as a side line since they are propagated during the inactive season for shad. The output of 1,797,000 striped bass fry in North Carolina represents a material increase and is in line with an effort to build up this valuable species.

Commercial species, interior waters.—Inasmuch as the supply of buffalofish and carp appears adequate for economic needs the hatchery production of these forms was curtailed and no carp whatever were distributed. Several of the States in the Great Lakes area are opposed to any promiscuous propagation or distribution of carp and the Bureau has coordinated its work accordingly. As a consequence the present contribution to the commercial fisheries of the interior section was the propagation of whitefish, lake herring, and lake trout carried on at Put-in-Bay, Ohio; Duluth, Minn.; and Cape Vincent, N. Y. Production of pike perch at Put-in-Bay was brought up to 334,000,000, a noticeable increase over 1938. The aggregate production of whitefish at the Bureau's stations amounted to approximately 33,000,000, somewhat lower than the previous year. Lake trout production at a level of slightly over 2,000,000 reflects the difficulty of securing eggs of this species. A new policy was adopted in connection with the propagation of the lake trout, however, by the reopening of the Bureau's hatchery at Charlevoix, Mich., for the purpose of rearing the fish to the fingerling size before release. Several hundred thousand lake-trout fry were supplied by the Michigan Conservation Department and were being fed at the Charlevoix hatchery at the close of the year. The activities at the Put-in-Bay, Ohio, station were conducted jointly with the State of Ohio, as has been the case for several years. It is felt that the State is in a position to take full responsibility for this work and at the close of the year negotiations were under way whereby the hatchery property might be turned over to the State.

Game species.—Again the collection of black-spotted trout eggs at Yellowstone Park was materially increased, the collection of eggs approaching 40,000,000. There was a moderate drop in the production of the other species of game trout, and a noticeable increase in the production of largemouth and smallmouth bass, the distribution amounting to over 14,000,000. Of this total, approximately 9,000,000 represented the fingerling and larger sizes which are so eagerly sought for restocking the tremendous area in which these two species thrive. The yield of the lesser warm-water species, including the sunfish, crappie, rock bass, warmouth bass, catfish, etc., was greatly below the levels maintained previously. However, as indicated elsewhere, this is of little significance as far as stocking is concerned because of the fact that the millions released in previous years were largely replanted directly in the Mississippi River in the area where they were salvaged. There was a continuation of the program for acquiring more distribution trucks, and the handling of fish applications was systemized and organized so as to coordinate the planting with the corresponding activities of the States. More and more of the game fish from Federal hatcheries are being utilized in stocking Federal lands, particularly in national forests, reclamation reserves, Indian reservations, and tracts which have been acquired in the land-utilization program.

The Bureau again made an allotment of rainbow trout eggs to Puerto Rico in continuation of the program for developing trout fishing in that Territory.

RESCUE OPERATIONS

The virtual completion of the 9-foot channel in the upper Mississippi River brought to a practical close the practice of salvaging fish in the overflowed areas and sloughs, which development has been predicted by the Bureau. There were handled in this activity only 2,800 fish of all species in comparison with the 40 to 50 million which were seined and returned to the river in the past. The Bureau, however, has proceeded with the construction of propagating ponds in the Refuge, particularly at Genoa, Wis., and Guttenberg, Iowa. The yield of game fish, especially bass, from these ponds has been most surprising and there is ample evidence of a continuing supply of bass and sunfish if the program of construction can be continued.

FISHERY INDUSTRIES

ECONOMIC AND MARKETING INVESTIGATIONS

Surplus fish situation.—The holdings of frozen, cured, and canned fishery products in the United States in the spring of 1939 amounted to about 172,000,000 pounds, according to a study of the surplus fish situation. This represents about 5,600,000 pounds more than normal holdings.

Survey of retail marketing of fish and shellfish.—The field work of a survey of retail marketing of fish in about 50 representative cities east of the Mississippi River was completed late in the fiscal year 1939. The results of the survey will be tabulated and analyzed to determine the factors which lead to the most favorable response from the public and to establish criteria which may guide retailers toward those practices which are most successful or promising.

Commercial fisheries of the world.—On the basis of the most recent available data, the world's annual commercial catch of fishery commodities amounts to about 33,600,000,000 pounds, valued at approximately $740,000,000. The United States, including Alaska, ranks first in the value of annual yield and is exceeded only by Japan in volume.

Cod fisheries off the east coast of North America.—In 1935, which is the most recent year for which complete statistics are available, the catch of cod off the east coast of North America by Canadian United States, French, and Portuguese fishermen, amounted to 1,109,000,000 pounds, as compared with an average annual catch of 1,108,000,000 pounds for the 10-year period from 1926 to 1935, inclusive, and 1,169,000,000 pounds for the preceding 10-year period. The most important country in the volume of its catch of cod in this area is Newfoundland, which took an annual average of 495,000,000 pounds during the period from 1931 to 1935. Following in order of the importance of their annual catches were Canada, France, the United States, and Portugal.

Cooperative marketing.—During 1938 work was continued on the collection of data relating to fishermen's cooperatives and other fishermen's organizations in this country and abroad. Appeals for aid

in organization of cooperatives have been received from many sections of the country and such assistance has been rendered as has been possible with the limited staff and funds available for this work. Arrangements have been completed to enlist the aid of statistical and marketing agents of the Bureau, who visit virtually all the fishing areas of the United States each year, to assist in keeping the Bureau's data on fishermen's organizations current.

STATISTICAL INVESTIGATIONS

FISHERIES OF THE UNITED STATES, CALENDAR YEAR 1937

New England States.—The commercial fisheries of Maine, New Hampshire, Massachusetts, Rhode Island, and Connecticut in 1937 gave employment to 19,624 fishermen who took 670,864,000 pounds of fishery products, valued at $19,937,000. This is an increase of 2 percent in volume and 11 percent in value as compared with 1935 when the most recent previous survey of the total catch was made. Landings by United States fishing vessels at Boston and Gloucester, Mass., and Portland, Maine, in 1937, amounted to 387,960,000 pounds, valued at $9,790,000—a decrease of 6 percent in volume and 12 percent in value as compared with 1936.

Middle Atlantic States.—During 1937 the commercial fisheries of New York, New Jersey, Pennsylvania, and Delaware gave employment to 7,720 fishermen. Their catch amounted to 264,652,000 pounds, valued at $7,896,000—a decrease of 5 percent in volume but an increase of 23 percent in value as compared with the catch in 1935 when the preceding complete survey of the catch was made. A survey of the Hudson River shad fishery for 1937 showed that 613 fishermen took 2,732,000 pounds of shad, valued at $213,000—an increase of 11 percent in volume and 25 percent in value as compared with the catch in the previous year.

Chesapeake Bay States.—In 1937 the commercial fisheries of Maryland and Virginia employed 16,529 fishermen. Their catch amounted to 292,244,000 pounds, valued at $6,361,000—a decrease of 7 percent in volume and 2 percent in value as compared with the previous year.

South Atlantic and Gulf States.—The commercial fisheries of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas gave employment to 30,244 fishermen in 1937. Their catch amounted to 546,751,000 pounds, valued at $14,226,000—a decrease of 2 percent in volume but an increase of 5 percent in value as compared with the previous year.

Pacific Coast States.—During 1937 the commercial fisheries of Washington, Oregon, and California gave employment to 21,555 fishermen, whose catch amounted to 1,576,877,000 pounds, valued at $28,776,000. This is a decrease of 18 percent in the volume but an increase of 16 percent in the value of the catch as compared with the previous year. The total catch of halibut by United States and Canadian vessels in 1937 amounted to 48,659,000 pounds, valued at $3,828,000—an increase of 1 percent in volume and 6 percent in value as compared with the catch in the preceding year.

Lake States.—In 1937 the commercial fisheries of the United States and Canada, in the Great Lakes and international lakes of northern Minnesota (Lakes Ontario, Erie, Huron, Michigan, and Superior,

Namakan and Rainy Lakes, and Lake of the Woods), yielded 116,064,000 pounds of fishery products. Of this amount, United States fishermen took 83,958,000 pounds, valued at $6,033,000—a decrease of 11 percent in volume and 6 percent in value as compared with the catch in the previous year. The Lakes fisheries of the United States gave employment to 6,418 fishermen in 1937.

Mississippi River and tributaries.—Complete data on the fisheries of the Mississippi River and its tributaries were not obtained for 1937. The catch of Lakes Pepin and Keokuk and the Mississippi River between the two lakes in 1937 amounted to 5,585,000 pounds, valued at $226,000—a decrease of 32 percent in volume and 40 percent in value as compared with the catch in these waters during 1936.

MANUFACTURED PRODUCTS OF THE UNITED STATES AND ALASKA, CALENDAR YEAR 1937

Fresh and frozen packaged fishery products.—In 1937 the domestic production of fresh and frozen packaged fishery products amounted to 201,803,000 pounds, valued at $27,678,000. Important commodities in this group were fresh-shucked oysters, 6,644,000 gallons, valued at $9,081,000; packaged haddock, 30,187,000 pounds, valued at $4,162,000; and fresh-cooked crab meat, 8,300,000 pounds, valued at $2,822,000.

Frozen products.—The production of frozen fishery products in 1937 amounted to 168,224,000 pounds, estimated to be valued at $14,600,000. The volume of the production was 6 percent less than in 1936. The principal items frozen were groundfish, whiting, salmon, halibut, and rosefish.

Cured products.—The production of cured fishery products, based on surveys for 1937 in all sections except the Mississippi River, and for 1931 in that area, amounted to 104,339,000 pounds, valued at $15,636,000. Important products in this group were smoked and kippered salmon, 12,173,000 pounds, valued at $3,515,000; salted cod, 19 857,000 pounds, valued at $2,379,000; and mild-cured salmon, 9,615,000 pounds, valued at $1,863,000.

Canned fishery products.—In 1937 the production of canned fishery products amounted to 742,197,000 pounds, valued at $105,175,000—a decrease of 7 percent in volume but an increase of 11 percent in value, as compared with 1936. Canned salmon was the most important item, accounting for 362,642,000 pounds, valued at $52,924,000. Other leading canned fishery products were tuna and tunalike fishes, sardines, shrimp, mackerel, clam products, and oysters.

Byproducts.—The production of fishery byproducts in 1937 was valued at $36,804,000—an increase of 17 percent as compared with the previous year. The principal products in this group were marine-animal oils and meals and aquatic shell products.

FISHERY MARKET NEWS SERVICE

The past year has been one of intensive activity in the development of the Fishery Market News Service and in the opening of new offices. Field offices for the daily collection and dissemination of fishery market news are now operating in New York, N. Y.; Boston, Mass.; Chicago, Ill.; Seattle, Wash.; and Jacksonville, Fla. In addition to these offices for the preparation and dissemination of daily reports,

the service also operates numerous news-reporting activities in important fish-producing areas along our coasts. These reporting activities make possible the inclusion of a much wider coverage of news in the daily reports of our field offices than would otherwise be possible. Periodic market news reports also are prepared and disseminated from the Washington office. These include summarized data made available through the daily and monthly reports of the field offices as well as articles relating to the commercial fisheries and other related information.

TECHNOLOGICAL INVESTIGATIONS

Preservation of fishery products for food.—During 1938 projects in this field included studies of rancidity in fish, of lactic acid as a possible index of decomposition in frozen fish, of identification of canned salmon, of changes in the composition of pink salmon, of the composition of commercial species of fish taken on the Pacific coast, and the canning of aquatic products.

Of particular interest has been the work on lactic acid as a possible index of decomposition in frozen fish. It is known that lactic acid rises to a maximum content in fish muscle during the rigor of death. It has also been shown that the alkaline reaction of fish muscle and the accompanying onset of spoilage of the fish follows after the loss of muscular rigor. Since spoilage occurs after the lactic acid content of the fish muscle reaches a maximum, the determination of lactic acid in fish flesh before and during a period of cold storage is of value in obtaining direct knowledge of the processes of decomposition of fish.

Information has been obtained regarding the changes in the chemical composition of pink salmon accompanying the pronounced physical change during their spawning migration and while in the commercial fishery. Additional data have been collected in connection with the development of a means for identifying the various species of salmon after canning. A survey has been undertaken to determine the chemical composition of the principal food fish of the Pacific coast, and the wastage occurring during their preparation for market. Studies were continued to determine the effectiveness of certain natural antioxidants in preventing rancidity in preserved fishery products and an attempt is being made to develop a simple and accurate method for measuring oxidative deterioration in fatty fish.

Bacteriological studies.—During the past year important bacteriological problems were studies of ultraviolet rays in killing bacteria, studies in the handling of fresh oysters, and studies of methods of preparing crab meat.

The studies in the handling of fresh oysters revealed that there is a definite relation between the pH in oysters and the bacterial count. The experiments showed that the bacterial flora changes with the acidity of the oysters and the bacterial count rises as a result of the increased acidity of the oysters. It was further discovered that excessive washing of oysters with fresh water caused a loss of mineral content.

At the request of several members of the crab-meat industry, the Bureau assigned a chemist and a bacteriologist to investigate possible measures designed to improve the quality of their product. This investigation included a survey of the crab-meat packing plants with

a view to making recommendations as to improved methods of handling and packing for shipment which would assure the public a higher quality product. Tentative recommendations were made to the crab-meat packers pending the issuance of a completed report.

Pharmacological studies.—As indicated in previous years, the role of minerals in nutrition has become increasingly important. Fishery products are considered to be an excellent source of minerals in quantity and variety, and a better understanding of the physiological effects of these minerals on the animal organism is necessary. During 1938 the Bureau's technologists completed a study of the chemical and pharmacological aspects of fluorine in fishery products. No toxic symptoms were observed when the fluorine in the diet came from salmon or mackerel.

Nutritive value of fishery products.—During 1938 investigations in this field included a study of the chemical composition and nutritive value of fish proteins, the vitamin content of fishery products, a study of sodium alginate (produced from sea kelp) as a stabilizer in products of the dairy industry, and a cooperative study of kelp meal in animal feeding at the dairy department of the University of Maryland and of the Maryland State Agricultural Experiment Station, College Park, Md.

The studies of the mineral constituents of fishery products showed that fish fillets are about equal to the muscle cuts of beef in mineral content, except that the fish greatly exceeds the meat in iodine content; that canned salmon contains about 15 times as much calcium, almost twice as much phosphorus, 20 times as much iodine, and approximately equal quantities of other minerals as beef round; and that oysters, shrimp, and crab meat contain approximately half as much calcium, more than 5 times as much magnesium, and more phosphorus than an equal quantity of milk. In addition, these shellfish are a particularly good source of iron, copper, and iodine.

The results of the studies on the chemical composition and nutritive value of fish proteins showed that, by using an arbitrary factor of 100, the proteins of the following fish and shellfish fell into the following groups according to relative growth-promoting value, as compared to beef at a factor of 63: Oysters, 100; pilchard, red snapper, shrimp, and Boston mackerel, 90; and shad, cod, croaker, and silver salmon, 80.

The results of the studies on sodium alginate showed that this product is an excellent mechanical stabilizer for use in food products, due to its chemical and physical properties and high viscosity value.

Preservation of fishery byproducts.—During the year data have been obtained regarding specific problems of salmon cannery waste utilization. These include investigation of the suitability of small-unit operations for canneries whose outputs are too small to warrant installation of standard fish-meal equipment, the preparation of edible salmon oils, the preparation of dehydrated protein and vitamin concentrates, and in the case of large canneries having short operating seasons, the chemical preservation of waste for subsequent reduction and the conversion of waste into new types of products as a result of chemical treatment. A survey was undertaken to determine the potential vitamin value of the livers and viscera of the principal food fish taken commercially on the Pacific coast. In cooperation with the Division of Fish Culture and the University of Washington

School of Fisheries, information was obtained which helps to clarify the steps in preparation responsible for improving the nutritional properties of fish meal for fish feeding and which suggest less costly processes of manufacture. Also, studies were made which indicate the possibility of materially reducing the danger of spontaneous heating of fish meal, a difficulty which now causes the industry great inconvenience and considerable financial loss.

BIOLOGICAL FISHERY INVESTIGATIONS

INVESTIGATIONS OF COMMERCIAL FISHES

North Atlantic fishery investigations.—In the offshore fisheries of New England, analysis of extensive data collected during the course of the haddock investigation has thrown considerable light on the changes in the abundance of this species and has suggested a plan for the stabilization of yield. Years of poor survival are either years in which large haddock are especially abundant, offering serious competition for food, or years when the stock of adults has been so reduced as to furnish insufficient spawners. The most favorable level was approximately that which prevailed in 1922 to 1924, 1929, and 1936. The course of the natural cycles of abundance may be seriously interfered with if a period of intensive fishing happens to coincide with a period of poor survival of the young. The recent marked decline in the abundance of haddock, which has been evident both on Georges and the Nova Scotian Banks has been shown to be the result of such a combination of circumstances. It is indicated, therefore, that by holding the population at the optimum level by regulation of the fishing intensity, it would be possible to sustain the yield at a productive level.

Data collected during the year on the age composition of the catch revealed an increasing dependence on the young or "scrod" haddock, a trend which is regarded as prejudicial to the interests of the fishery, inasmuch as these fish are growing rapidly and would be of considerably greater value if allowed at least 1 more year's growth.

The catch records and biological data collected during the 1937 mackerel season, a year of extremely low production, were subjected to analysis during the year. The composition of the mackerel population differed markedly from previous years in that no year class or classes dominated the fishery. With the exception of the 1932 class, year classes following 1929 were present in better than 5 percent strength each. Inasmuch as a study of lightship temperature records revealed that water temperatures in the western part of the Gulf of Maine ran higher than the average for the previous 10 years, it is suspected that hydrographic conditions affected the distribution of mackerel and were an important factor in the low catch.

The catch for the 1938 season was almost double that of 1937, but the early season landings for 1939 sank to a lower level than those for the corresponding period of 1937. Biological data show that the mackerel spawned in 1937, a group that was expected to contribute much to the fishery, as 2-year-old fish were virtually unrepresented in 1939. Because pound-net fishermen inshore were reported to be making good catches, an investigation of the relation between the catch by seiners offshore and that of the pound nets was begun early in the 1939 sea-

son to determine to what extent changes in the offshore catch may represent merely changes in the distribution of mackerel.

During the fiscal year 1938 a study was undertaken to determine whether a decline in abundance of flounders is in progress in the North Atlantic area. In order to interpret fluctuations in abundance, it was necessary to develop techniques for determining age and growth, the existence of separate races within the population, and the extent of migrations.

Owing to the increased utilization of redfish, flounders, and other species of groundfish in addition to haddock, an investigation of the abundance of such fishes was begun during 1938. The central problem is to assess total catch, fishing effort, and abundance in order to determine for each species whether it has already reached the point where an increase in yield will give a larger production only with detriment to future supplies.

As a result of cooperation between the Bureau of Fisheries and the State of Maine, an investigation to test new methods of rearing lobsters, to determine the relative effectiveness of artificial and natural propagation, and to ascertain the condition of the lobster fishery on the coast of Maine has been added to other scientific fishery investigations being conducted in the New England area. The State has constructed a lobster-rearing plant adjacent to the Bureau hatchery at Boothbay Harbor, with facilities for carrying on experimental work, and has assigned funds for the employment of a biologist. Experiments with larval lobsters and tagging of adults were begun during the spring of 1939.

Middle and South Atlantic fishery investigations.—At the request of the New York State Conservation Department, the Bureau participated in a biological survey of the marine fisheries of Long Island, acting principally in an advisory capacity. The survey was undertaken to provide a basis for improving or maintaining good fishing wherever the supply is controllable and to determine by a census of fishing activities the recreational and commercial value of the marine district of Long Island. Definite recommendations for the conservation of several species and for additional study have been included in a report to be published by the State.

Evidence continued to accumulate which indicated an inadequate spawning escapement as the principal cause of the decline in abundance of shad along the Atlantic coast. Much of the field work of this investigation has been directed toward comparison of the spawning escapement in the Hudson, where complete recovery of abundance has occurred, with the escapement in other rivers which are still severely depleted. The principal methods of study are tagging experiments, designed to estimate fishing intensity from the percentage of tags recovered, and studies of scales intended to estimate the percentage escapement from the percentage of scales bearing spawning marks.

Prior to recommending measures to insure an adequate number of spawners in the various coastal rivers, it was necessary to determine whether shad return to spawn in their native rivers or whether, as many fishermen believe, there are extensive migrations. A direct attack on this problem has been made by tagging. Results of tagging experiments in North Carolina, the Chesapeake Bay, and the

Hudson indicate that the great majority of shad return to the same river year after year. Additional data on this point are being gathered by extensive analysis of the racial characteristics of shad from the different rivers.

Because of the importance of reproduction in shad conservation a careful ecological study of the early life history is being made in southern rivers. In 1938 intensive work was done in the Edisto and in 1939 these studies were extended to other rivers.

Shrimp investigations.—Studies of the shrimp fishery consisted of several cruises to assess available supplies in the offshore waters of the Gulf of Mexico, a continuation of tagging experiments to determine the seasonal migrations of shrimp along both the Atlantic and Gulf coasts, and ecological studies of the relationship between environmental changes and the distribution of shrimp along the Texas coast.

As a result of a cruise of the *Pelican* along the Louisiana and Texas coasts in January and February, the presence of shrimp off the Louisiana coast in concentrations sufficient to warrant commercial exploitation was confirmed. No large concentrations of commercial shrimp were found off the Texas coast. In a later cruise a similar lack of commercial shrimp was observed off the coasts of Alabama and Florida between Mobile Bay and Apalachee Bay.

Tagging of shrimp on the Atlantic coast from Cape Canaveral to St. Augustine, where the bulk of the South Atlantic coastal shrimp congregate for the winter, gave evidence of a return movement at least as far as 250 miles northward. Other tagging experiments indicated that the small shrimp do not engage in coastwise migrations as extensively as do the larger sizes.

In cooperation with the Texas Game, Fish, and Oyster Commission, a program of hydrographic surveys and experimental trawling was instituted in Aransas Bay to determine the extent to which hydrographic factors may control the distribution of shrimp and day-to-day fluctuations in the catch.

North Pacific and Alaska fishery investigations.—Commercial fishery investigations in northern Pacific waters form the basis of recommendations for the management and conservation of the salmon runs in the rivers of the Northwestern Coastal States. They are also concerned with maintaining at a productive level the salmon and herring fisheries of Alaska, over which the Federal Government has regulatory power.

The activities of the Columbia River staff have centered about the problem created by the erection of Grand Coulee Dam, blocking that portion of the Columbia River salmon run that normally spawns in tributaries of the upper Columbia. Salvage operations were begun in 1939. The runs are being trapped at Rock Island Dam, 150 miles downstream, and transferred in specially constructed trucks to tributaries between Rock Island and Grand Coulee Dams. It is hoped that the fish will spawn in these tributaries, and that their progeny will later return to them. If the plan yields the anticipated results, the entire run of upper Columbia fish will be transferred to tributaries below Grand Coulee within a period of 5 years, or the life cycle of a salmon.

At the beginning of the fiscal year 1939 Congress made funds available to the Bureau of Fisheries for a large-scale study of the factors that control the salmon populations of Bristol Bay in order that a sound and comprehensive system of management might be applied. With the cooperation of the Coast Guard, extensive hydrographic observations were conducted in the summers of 1938 and 1939. Biological observations were made also to discover the schooling habits of the fish far offshore, the abundance and distribution of food animals, and the migratory habits of the salmon in approaching the coast from these offshore feeding grounds. Correlated with these oceanographic studies, investigations of the life cycle of the salmon in the five major watersheds of this area are under way. These include detailed population studies of the spawning runs, surveys of spawning grounds, and measurement of the mortality of the young in fresh water. This investigation is planned to cover a 5-year period, or the normal life cycle of the red salmon.

Studies of the returns to be expected from any given escapements of spawning salmon were continued in the Karluk watershed. Further evidence was secured that variations in the ratio of returns to escapement are mainly due to conditions existing in the fresh-water environment. To determine the role of the predatory Dolly Varden trout in reducing the number of young red salmon, the migratory habits and biological characteristics of the populations of trout have been investigated through the tagging of large numbers of these fish.

In areas where the migration routes of salmon pass through commercial fishing areas to a number of different streams, the 50-percent escapement required by law cannot be assured unless the exact routes of the salmon and their distribution on the spawning grounds are determined. Tagging experiments were conducted during the 1938 and 1939 seasons to trace the migration routes of pink salmon passing through Lower Chatham Strait. The two experiments will provide information covering the routes of migration of both the odd- and even-year pink salmon runs.

The usual population studies to determine the size of the pink-salmon runs and the proportion of males and females were conducted at Little Port Walter. The construction of a permanent dam and counting weir, which was in operation during the 1939 season, now permits an accurate count of seaward-migrating young as well as upstream migrants, so that the returns from a known number of spawners may be determined with greater accuracy than heretofore. Changes in the time of appearance of the pink salmon runs are being closely analyzed so that any necessary curtailment of the fishery may be effected in time to allow an adequate escapement to the spawning grounds.

As an aid to rebuilding the runs of coho salmon in Puget Sound, studies have been carried on over a period of years to determine the age at which hatchery-reared fry may be released most advantageously. A series of marking experiments for this purpose was concluded in 1938. Biological studies of the size and age composition of the population were made by taking samples of the commercial catch and of the fish on the spawning grounds.

Studies of the age composition of the herring population of southeastern Alaska were responsible for demonstrating that this stock

has declined to a dangerously low level and that curtailment of fishing is necessary. The decline has been caused by the virtual failure of three successive broods, those of 1932, 1933, and 1934, combined with excessive fishing. Closure of the Cape Ommaney area was recommended until the population shows definite signs of recovery. The fishery of the Prince William Sound and Kodiak areas continued at a high level of abundance, but since considerable expansion is contemplated, a close watch must be maintained to avoid overexploitation.

Collection, tabulation, and analysis of the daily catch records from the various types of fishing gear operated by the salmon fishing industry in Alaska have been continued. Indexes of abundance derived from these data are an important basis of recommendations for changes in the fishing regulations.

Pilchard investigations.—Although biologists of the Pacific Coast States have already collected a considerable body of information bearing on the migrations, spawning, and age and growth of the pilchard, the basic problem remaining for solution is the determination of the optimum level of catch below which the stock would go to waste through underutilization, above which it would become reduced to commercial unimportance through overexploitation. To provide a basis for determining this level, the staff conducted studies dealing with the determination of abundance, age, and reproductive success, and with the importance of intermigration.

The use of aerial observers in gaging abundance was tested but rejected as unsatisfactory. Changes in relative abundance are therefore being determined by statistical analysis of the commercial catch records over a period of years.

To discover how much the stock is reduced by fishing it is necessary to determine the ages of the fish making up the population each year, thus learning the relative abundance of the individual broods of previous years and how fast they are removed by fishing and by natural mortality. Age determination is being attempted by interpreting marks in scales and otoliths, by observing the growth of young pilchards, and by identifying modes in frequency distributions of the adult population.

During the spring of 1939 several cruises were made in the spawning and nursery grounds, quantitative samples of the young pilchards being taken. These cruises were made possible by the cooperation of the Scripps Institution of Oceanography, which furnished the vessel *E. W. Scripps*. When the surveys are completed, it is hoped that light may be thrown on the distribution and abundance of eggs and young, as well as on the effect of oceanic conditions on the success of spawning.

To determine whether the pilchard stock in northern waters is self-perpetuating or is maintained by migrations from other areas, techniques are being developed for appraising the contributions from various spawning areas through study of the sculpturing on the scales. If the method proves valid, it will aid in determining how much fishing in specific areas affects the stock in other areas.

Great Lakes fishery investigations.—A state of critical depletion continues to exist among the more valuable commercial species of the Great Lakes. The extent of this depletion is apparent from

comparisons of present-day production of certain species with yields of earlier years. In Lake Michigan, for example, production of wall-eyed pike, lake herring, lake trout, whitefish, and yellow perch varies from 43 to 62 percent of normal. Production of Lake Superior whitefish is only 10 percent of normal. In Lake Huron production of perch and chubs is 44 and 36 percent, respectively, of normal. In Lake Erie production of nearly all important commercial species is on the decline, and total production of Lake Ontario is only 10 percent of normal.

Members of the Great Lakes staff cooperated actively with State and Federal officials and with sport and commercial fishermen, participating in an advisory capacity in 19 meetings and conferences in which Great Lakes fisheries problems were under consideration and assisting State conservation officials in the drafting of fisheries regulations.

At the request of the Office of Indian Affairs of the Department of the Interior, a survey was made of the fisheries of Upper and Lower Red Lakes in Minnesota to settle various controversies concerning the regulation of the commercial gill-net fishery. Recommendations for the management of the fishery are being submitted.

The report of the International Fact-Finding Commission on Lake Champlain was largely completed. The report will contain a discussion of the fisheries controversies, a tabulation and analysis of all available information concerning commercial fishing and angling, descriptions of the natural history of the various species, a critical historical review of the artificial propagation of wall-eyed pike and yellow perch, and recommendations for the regulation of the commercial and sport fisheries of the lake.

Age and growth studies of the whitefish of Lake Huron and Lake Champlain were completed for publication, and life-history studies of the yellow perch were continued.

AQUICULTURAL INVESTIGATIONS

The work of the aquicultural investigations continued along three principal lines: The development of means to obtain the maximum production of food and game fishes consistent with environmental conditions, the improvement of methods of artificially propagating and rearing fish, and the control of fish parasites and diseases.

Investigations were conducted in trout waters to obtain definite information on the annual drain to which the trout population is subjected by anglers and the value of artificial stocking in maintaining a stable fish population. Such studies were conducted through the operation of test waters in Vermont; experimental stocking of streams in the Pisgah National Forest where fishing is closely supervised and an accurate check on returns may be obtained; and the operation of the Convict Creek experimental stream in California. These studies have demonstrated that in some situations natural propagation is superior to artificial in maintaining a stock of trout under adverse conditions and have emphasized the necessity of regulating planting operations in accordance with the amount of natural food present in the streams.

Feeding experiments with fingerling, yearling, and adult trout were carried out at the Leetown, W. Va., and Pittsford, Vt., stations to determine the effect on growth, mortality, and egg production of dry meals fed at different levels and in different combinations. One of the most striking results was the marked increase in growth following the addition of cod liver oil to a diet composed of sheep liver and whitefish meal. Experiments with brood fish showed considerable variation in the hatchability of eggs from fish on different diets.

During the year a regional biologist was appointed to resume fish management work in the Intermountain Region. In this area fishing intensity is increasing rapidly and many of the streams are unable to maintain a sufficient fish population to meet demands. In addition to overfishing, adverse changes in the streams and lakes are important factors in the general decline. Among such changes might be cited silting resulting from overgrazing, hydroelectric and irrigation projects that interfere with normal migrations, and fluctuations of water level in artificial lakes. Management plans have been worked out for several waters showing possibilities of early improvement of fishery resources.

The staff of the California trout investigations has been engaged in determining the number of salmon and the extent of spawning streams that will be blocked by the completion of the Shasta Dam on the Sacramento River. The estimates of the 1938 fall run combined with the counts of the 1939 spring run fish indicate that approximately 25,000 salmon a year will ultimately have to be handled in the salvage operations. Pending the completion of engineering surveys to determine the feasibility of certain alternative features of the plan, a tentative program has been drafted which calls for a combination of artificial propagation and provision of areas for natural spawning below the dam.

Field work in bass streams was designed to measure the extent and efficiency of natural propagation and the effect of intensive fishing on the bass population. An important result of these studies was the finding that even in heavily fished waters there is little danger of serious depletion of bass if adequate spawning facilities are available. However, intensive fishing frequently leaves excessive numbers of small bass, with consequent reduction in the abundance of forage fishes. It is apparent that the remedy is to build up the food supply and that stocking with young will only serve to intensify the unbalanced condition. Programs for the effective management of bass in ponds and lakes are being developed in Florida.

Facilities for the experimental study of fish diseases were greatly increased during the year with the enlargement of the field laboratory at the Quilcene, Wash., hatchery, and the provision of a second experimental laboratory through the cooperation of the University of Washington. Studies of various disinfectants used in the prevention and treatment of disease were continued to determine the maximum nontoxic concentrations that the fish could withstand. Studies of common bass parasites, believed to be an important factor in the mortality of the young, were carried on at Leetown, W. Va. The Disease Service continued to aid Federal, State, and private fish-culturists in the diagnosis of hatchery disease.

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POLLUTION INVESTIGATIONS

Field and laboratory studies have been continued over a wide area of the country for the purpose of analyzing stream and hatchery waters from the standpoint of their suitability for various types of fishes and of determining the harmful actions of specific pollutants. Methods of determining the physiological condition of the fish themselves have been markedly improved.

Many of the findings of the past year are of considerable interest and importance. For example, it has been found that arsenicals and other materials commonly used as mosquito larvacides impair the growth and nutrition of fishes even though used in very small quantities, and may also build up serious hazards of lethal poisoning. It has also been demonstrated that small quantities of many substances, normally present or introduced into streams and lakes, may have a cumulative effect over a period of time that is even more detrimental to fish life than many more obvious pollutants. Certain minerals found in small quantities in various western streams and several inorganic salts that are common in southern and western waters exert this type of cumulative action.

Problems arising from the concentration of minerals and other compounds hazardous to fish and other aquatic life in impounded waters have been investigated at Elephant Butte Reservoir, N. Mex., and Lake Mead, Nev.

Acute pollution problems were investigated during the year in Florida, South Carolina, North Carolina, Minnesota, Idaho, Montana, Oregon, and Mississippi. Specific types of industrial pollution studied include that produced by paper mills, phosphate mines, and copper, lead, zinc, and placer gold mining operations.

CONSTRUCTION OF FISH-PROTECTIVE WORKS

A section on hydraulics has now been established under the supervision of the Division of Scientific Inquiry, with an experienced engineer for the design of fish-protection facilities. During the year the engineer assisted in designing and supervising the installation of fish screens being constructed with the aid of P. W. A. and W. P. A. funds on certain Federal power and irrigation projects in the Northwest. Important consulting services on screens and ladders were also afforded to other agencies.

SHELLFISH INVESTIGATIONS

Scientific investigations have been directed toward increasing the cultivation of oysters, improving the quality of oyster meat, and standardizing the raw and canned product.

In the Long Island Sound area, where the collection of a good crop of seed oysters is of paramount importance to the industry, regular bulletins were issued during both the 1938 and 1939 seasons advising oystermen when spawning and setting might be expected. To aid in protecting valuable beds from starfish, surveys of the distribution of this oyster enemy were made and the results communicated to oystermen, permitting more efficient eradication.

On the south Atlantic coast, although generally favorable conditions for growth are found, some beds are badly overcrowded. Experiments are being conducted to develop a method of protecting seed oysters from the attachment of larval oysters, barnacles, etc., so that they may be grown to marketable size as single individuals of good quality.

Experimental oyster beds have also been established in South Carolina to develop methods of cultivation suitable for small oyster farms, from 2 to 10 acres in extent, to be leased and operated by the tidewater residents. The program differs from previous experiments in presupposing that capital requirements will be at a minimum and that materials, equipment, and supplies will be obtained or produced by the labor of the oyster farmer himself.

At the Pensacola, Fla., laboratory an experimental oyster farm is being established to determine rates of growth and fattening, productivity annually per unit of bottom, and costs of production. The results will be compared with those of similar projects conducted on the Atlantic coast. A program of oyster planting and of rehabilitation of exhausted natural beds is also being conducted from this laboratory.

Investigations carried out at the Yorktown laboratory demonstrated that pollution of the river by pulp-mill wastes has brought the decline of the oyster fisheries. During the past year intensive chemical studies were carried on for the purpose of determining the particular chemical or chemicals in the pulp-mill effluents which are responsible for the altered physiology of oysters. An attempt will then be made to find a means of eliminating the harmful substances.

Studies of the physiology of the oyster carried out at Woods Hole, Mass., included investigations of the phenomenon of sex reversal in adult oysters, experiments on the time of survival of eggs and sperm, and a study of respiration in relation to the carbohydrate metabolism of the oyster and the accumulation of elements which are important food constituents of oyster meat.

LAW ENFORCEMENT DIVISION

The act of July 2, 1931, the Federal Black Bass Law regulating interstate commerce in black bass, is administered by this Division; also certain parts of the Whaling Treaty Act of May 1, 1936, giving effect to the various international treaties for the protection of whales. The Division also maintains an angler's service, and issues permits to take bait fish in the District of Columbia.

The Federal black bass law.—The personnel and methods of enforcement remain the same as last year. Owing to insufficient personnel, no particular effort has been made to carry on the work west of the Rocky Mountains, where salmon and trout predominate. Reports of illegal interstate shipments of black bass have been investigated, producing evidence of violations of both State and Federal laws. A number of these cases have been turned over to the States for prosecution in State courts, as such action generally produces quick and effective results. Two cases of illegal interstate shipments of black bass by trucks were successfully prosecuted during the year, a fine of $100 and 1 day in the custody of the U. S. Marshal being

assessed in each case. The defendant in one of these cases remained in jail approximately 3 months previous to trial, being unable to furnish the required bond.

Improvements in State laws protecting black bass have been continued in accordance with the Bureau's recommendations for adequate protection. Thirty-nine States now prohibit the sale of black bass at all times, regardless of where taken, and all but four States provide a closed season on these game fish during at least a part of the spawning period. The States have cooperated 100 percent in carrying on this branch of the work. A summary of the game-fish laws for 1937–38, with special reference to black bass, was prepared and published, also several leaflets on subjects pertaining to angling.

Whaling.—The total number of licenses issued for taking whales was 15—covering 3 shore stations and 12 catcher or killer boats. The total revenue received for these licenses was $4,750 which was covered into the United States Treasury.

The Division prepared, in accordance with the terms of the Whaling Convention of September 24, 1931, two statistical reports covering the number of whales captured, species, size, etc., and has made biological studies of the samples of stomach contents taken from whales captured by United States vessels. It has completed two biological reports which, together with the two statistical reports, were forwarded to the International Bureau of Whaling Statistics, Sandefjord, Norway, as required under the convention.

Angling.—Requests for information on how, when, and where to fish with rod and line have increased during the fiscal year. Thirty-nine permits, required by act of Congress, to take certain small bait fish in the District of Columbia were issued.

VESSELS

Fifteen vessels of the Alaska service cruised approximately 107,000 nautical miles in the fiscal year 1939, as compared with 117,000 miles in the previous year. The *Penguin* covered about 30,000 miles, the *Teal* 11,000 miles, and the *Crane* 9,000 miles. Owing to the accidental grounding of the *Brant* on Williams Reef on July 15, that vessel was out of commission during a considerable part of the season, and its total mileage in the fiscal year was only about 8,000 miles.

The *Penguin* made five round trips between Seattle and the Pribilof Islands, carrying personnel and emergency supplies. Interisland service also was performed, and native workmen from the Alaska Peninsula were transported to the Pribilofs to assist with sealing activities. Two trips were made to the western Aleutians in connection with sea-otter investigations and patrol.

The *Auklet*, *Kittiwake*, *Merganser*, *Murre*, and *Widgeon* were engaged in fishery protective work in southeast Alaska. The *Eider* operated in the Kodiak area, the *Ibis* at Chignik, the *Red Wing* in the Alaska Peninsula area, and the *Coot* on the Yukon River. The *Blue Wing* was on Prince William Sound and also assisted in the patrol of southeast Alaska.

The *Teal* operated on Cook Inlet, carried on the stream survey in the Prince William Sound area, and assisted in the stream survey and general patrol in southeast Alaska. The *Crane* transported per-

sonnel and supplies between Seattle and Bristol Bay and patrolled the Alaska Peninsula area. The *Scoter* was used on Bristol Bay and relieved the *Crane* in the Alaska Peninsula area for about 10 days.

The *Brant* was used in general supervisory work, chiefly in southeast Alaska, although a trip was made westward as far as Anchorage. In December this vessel transported employees of the Bureau between Seattle and points in southeast Alaska for the conduct of hearings on the Alaska fishery regulations. The *Brant* was based at Juneau for approximately 3 months at the beginning of the year to render service in connection with the biennial session of the Territorial Legislature.

The *Scoter* engaged in the fur-seal patrol in the vicinity of Neah Bay, Wash., in the spring of 1939.

The *Pelican* was engaged in exploratory trawling to determine the abundance and distribution of shrimp in the offshore waters of the Gulf of Mexico.

APPROPRIATIONS

Appropriations for the Bureau for the fiscal year aggregated $2,220,200, as follows:

Salaries, Bureau of Fisheries	$150,000
Propagation of food fishes	962,000
Construction of fish screens	20,000
Maintenance of vessels	173,000
Inquiry respecting food fishes	338,000
Fishery industries	83,600
Fishery market news service	70,000
Alaska fisheries service	270,000
Enforcement of Black Bass and Whaling Treaty Acts	17,000
Mississippi Wild Life and Fish Refuge	17,900
Fish cultural station	6,500
Travel expense	112,200
	$2,220,200

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