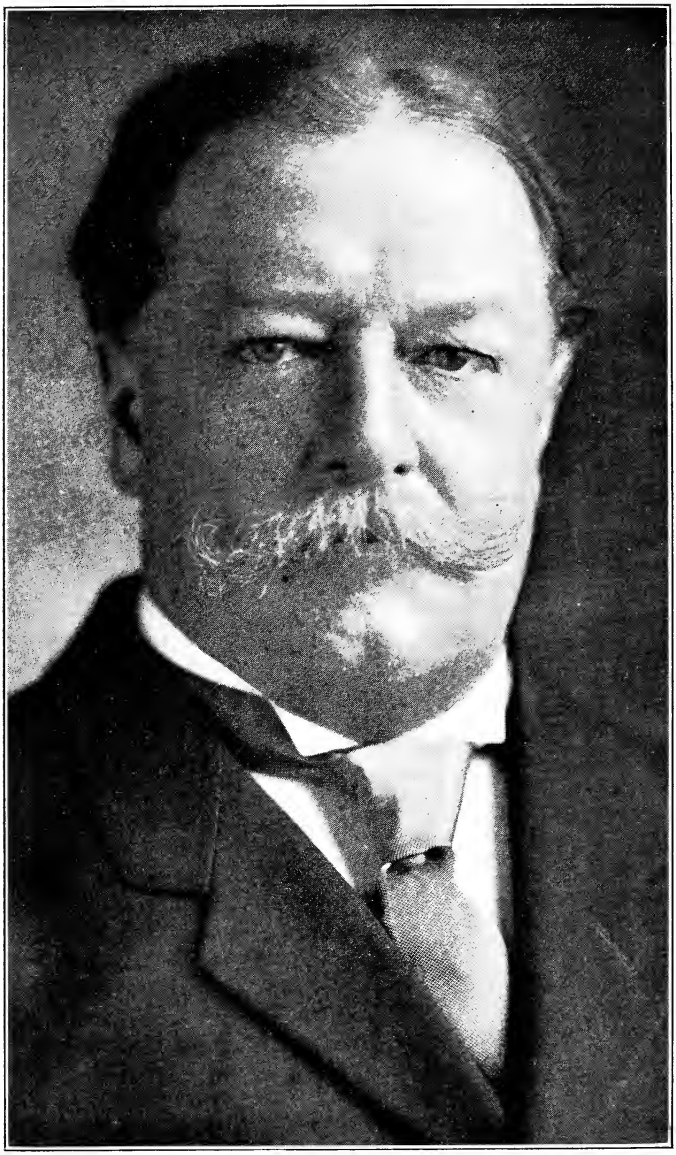
On June 24, 1904, President Roosevelt had made the Dingley tariff applicable to the Canal Zone. This worked badly and Secretary Taft agreed to have the order revoked, so that the Canal Zone ever since has enjoyed the freest of free trade. All other issues were cleared up without the United States yielding any freedom of action as to importing materials, executing justice, operating ship terminals and supplying canal employees with the necessaries of life through commissaries and hotels.

While Secretary Taft and Chief Engineer Wallace were working in their spheres, Gov. Davis was instituting the various departments of civil government which to-day are noted with admiration by the tourist. Chief of Police Shanton was engaged in ridding the Canal Zone of its bad men and bringing a population long without any restraint under the control of regulations that the Americans considered essential to orderly existence. So far as practicable, the laws to which the natives were accustomed, which had been handed down the centuries by the Spaniards, were adopted in taxing lands and other property, but the court procedure was American with the exception of the jury system. The judges acted as juries.

From the first Mr. Wallace had kept close tab on the cost of excavating dirt in the Culebra cut. The type to be chosen being still an unknown factor, he was in some measure working in the dark, except that the material removed would be useful for any type, provided the dumps were selected so as not to later get in the way of any route chosen. In 1912, the



PRESIDENT TAFT.

Americans had to remove a French dump near Culebra to prevent its slipping down into the cut. He finally announced a unit cost of 50 cents a cubic yard for either a sea-level or lock-type canal.

Messrs. Parsons and Burr, the engineering committee of the Commission, after a personal inspection of the Canal Zone, and taking Mr. Wallace's estimate, recommended a sea-level type of canal. It was to cost, exclusive of improvements in Colon and Panama, and civil government in the Canal Zone, $230,500,000. Mr. Wallace had caused surveys to be made for a lock type of canal, and he estimated the cost of such a canal, with a summit level of 60 feet elevation, to be $178,013,406; with a summit level at 30 feet elevation, the cost would be $194,213,406.

All three estimates missed the real cost of the respective types widely. Mr. Wallace's estimate of 50 cents a yard for excavation was far too low. As a matter of record, the cost reached 82 cents under Chief Engineer Stevens, rose to 91 cents under Chief Engineer Goethals, and only once fell below the 50-cent estimate, in March, 1911, when it fell to 47 cents a yard. The average for the period from 1904 to 1911 was 88 cents. The mistake was made because solid rock underlay the surface, necessitating continuous blasting before it could be handled by the steam shovels, while the working day, which had been ten hours under Mr. Wallace, was cut to eight hours under Messrs. Stevens and Goethals, and wages rose sharply as well.

Persistent and vigorous complaints from Mr. Wal-

lace, about the hindrances of governmental methods of doing business, found a receptive ear in President Roosevelt. The Executive was just as eager to make the dirt fly as Mr. Wallace, and readily agreed that a Commission of seven members was an awkward and ill-working management for the peculiar conditions of the job at Panama. Accordingly drastic action was decreed.

Secretary Taft, on March 29, 1905, asked the entire Commission to resign. His explanation exonerated the members of any blameworthy administration, but indicated that the Commission had been found an unwieldy body. Mr. Wallace was in Washington, and the President and Secretary Taft followed his suggestions almost to the letter, including the one that the Chief Engineer be made a member of the Commission.

On April 1, 1905, the second Isthmian Canal Commission to be appointed by President Roosevelt was announced. Heading it was a new figure in canal affairs, Theodore P. Shonts, who played a decisive part in the enterprise for the ensuing two years. The personnel of the new Commission was:

THEODORE P. SHONTS, *Chairman*,
CHARLES E. MAGOON, Governor of the Canal Zone,
JOHN F. WALLACE, Chief Engineer,
MORDECAI T. ENDICOTT,
PETER C. HAINS,
OSWALD H. ERNST,
BENJAMIN M. HARROD.

There was the same number of Commissioners, but the first three were named an Executive Committee which virtually should exercise the powers of the entire body. Thus power was taken from seven and concentrated in three members. Mr. Shonts was to be in charge of the Washington office and Messrs. Wallace and Magoon on the Isthmus.

Again following Mr. Wallace's suggestion, the directory of the Panama Railroad was reorganized, the United States on April 15, 1905, for the first time electing the members. Mr. Shonts was made president and Mr. Wallace, vice-president and general manager. This would further concentrate control in the Chief Engineer over a vital factor in canal construction.

These changes and other matters kept Mr. Wallace in Washington from March 29th to May 24th, about two months. The employees in the Canal Zone naturally caught something of the spirit of unrest which attended the reorganization of the Commission, and, of course, the hostile press was playing up everything that could embarrass the administration and damn the project. Then the yellow-fever epidemic broke out in April, 1905, to add a terrible phase to life on the Isthmus.

Having secured every change he desired, Mr. Wallace left Washington with expressions of cordial appreciation to the President and his Secretary. He arrived at Colon on June 2d, and the White House believed that a crisis in the career of the project had

been passed successfully. They looked forward to smooth sailing with every confidence.

Their surprise and chagrin, therefore, was immeasurable when Mr. Wallace cabled Secretary Taft, on June 8th, asking that he be recalled to Washington for a conference. He intimated that the conference might result in his resignation as Chief Engineer. After a disheartened interview with the President, Secretary Taft cabled him to return. At the same time he cabled Gov. Magoon for a confidential view of Mr. Wallace's conduct. Gov. Magoon expressed the opinion that Mr. Wallace was quitting for a better salary, the yellow-fever epidemic was raging, the wife of Mr. Wallace's secretary had died from the disease, and Mr. Wallace believed that he had had an attack of it.

Without intimating that he was leaving for good, Mr. Wallace quietly packed up or sold off his household furniture and sailed from Colon on June 16th. The employees scented some important movements and the subordinate officials felt restrained from decisive action, although Mr. Wallace left authority to that effect with the engineer next in rank to him.

Gov. Magoon cabled that the working force, already shaken by the yellow-fever epidemic, were further demoralized by the belief that the Chief Engineer was seeking a softer berth. Every ship that left Panama at that time was carrying capacity passenger lists, and only the limited number of vessels prevented a wholesale exodus. It was truly a time that tried men's souls.

President Roosevelt and Secretary Taft then decided upon a drastic course toward Mr. Wallace, as a means of reviving the morale of the canal workers, and also of bringing the American people sharply to a realization that the canal project was in peril, through a display of weakness in the face of danger, that would make our experiment in Panama an international disgrace.

Secretary Taft, with William Nelson Cromwell, met Mr. Wallace at the Manhattan Hotel in New York on June 25th. Secretary Taft listened to his reason for resigning, which in the main was that he had under consideration a position that would carry with it a remuneration of approximately $65,000 a year. One of the peculiar conditions of the new employment was that under no circumstances was he to return to the Isthmus, but that he would gladly remain a member of the Commission resident in the United States. He made some side criticisms to the effect that Col. Gorgas was incapable of handling the yellow-fever epidemic, that government red tape was distracting, and conditions generally were such as to make the new employment look attractive.

Secretary Taft did not conceal his disappointment in Mr. Wallace's course. He began by reviewing how the government had taken him from a position paying $15,000 a year to make him Chief Engineer of the canal at $25,000 a year; how that the formidable obstacles to be met, the supreme necessity of a canal to the nation, made it a patriotic work for any Amer-

ican and an honor to be placed at the head of the greatest enterprise of the age.

"For mere lucre," Mr. Taft continued, "you change your position overnight without thought of the embarrassing position in which you place your government by this action."

Secretary Taft then reviewed how the Commission had just been reorganized to meet Mr. Wallace's wishes, and every change had been approved by the Chief Engineer. He closed by demanding the immediate resignation of Mr. Wallace. This came the next day, and was made public on June 28th, with Secretary Taft's hot rebuke, which, in the Canal Zone, had a most salutary effect. It put an entirely new complexion on their work to be told that the nation expected every man to do his duty, that they were not down there for the money they could make, nor were they expected to leave because of the hardships they would meet, but that the object of their exile was to give the nation something vital to its welfare. The desertions began to diminish at once, and the announcement on June 30th, that John F. Stevens, a Hill man, had been appointed Chief Engineer, further strengthened the morale of the canal organization.

Theodore Roosevelt never appeared to better advantage as a supremely able executive than during this crisis in the history of the canal. Before his enemies, and the canal's enemies, could shout their glee at the demoralization of the enterprise, he had closed the breach with the selection of another great Chief En-

gineer. Even if the situation had been brought about by interests with sinister designs, it could not have been met with a more magnificent courage, and the canal project was strengthened by the ordeal.

CHAPTER XII

THE CANAL UNDER STEVENS

ANOTHER notable figure in the railroad world had been chosen Chief Engineer of the Panama Canal. John F. Stevens in 1903 was general manager of the Great Northern Railroad Company, and of his selection as Chief Engineer, James J. Hill said that if the whole country had been ransacked no better man could be found.

Mr. Stevens was about to start to the Philippine Islands to superintend the construction of government railroads, when drafted for the canal. It is not possible to estimate the mischief that might have resulted if the selection of a successor to Mr. Wallace had been long delayed. His salary was to be $30,000 annually, or $5,000 more than that paid to Mr. Wallace. He was facing a situation in Panama that justified the figure.

The long continued "knocking" of the canal project was having its effect. Not only were the men on the ground difficult to retain, but new ones would not come unless for exceptional considerations. The yellow-fever epidemic was still uncontrolled. An invoice of the situation as left by Mr. Wallace showed that considerable pioneer work had been done, but the housing, feeding, and general preparations for the comfort of employees were unsolved problems.

Mr. Stevens arrived at Colon on July 27, 1905. As a railroad man his eye first was attracted by the congestion of freight on the wharves and the self-evident fact that the Panama Railroad was in a near state of collapse. Freight was piled up in the streets in prodigious quantities and was moving over the railroad at a snail's pace. His first report hit off the situation in one sarcastic sentence:

"About the only claim for good work heard made was that there had been no collisions for some time. A collision has its good points as well as its bad ones —it indicates there is something moving on the railroad."

As for the railroad tracks in the Culebra cut, he said they were "lines, which by the utmost stretch of the imagination could not be termed railroad tracks." Mr. Wallace had found the Panama Railroad, after half a century without competition, far behind the times in equipment, and practically no discipline or efficiency existed among the employees. When Mr. Stevens took charge there was an improved situation, but the long absence in Washington of Chief Engineer Wallace, and his sudden departure, had caused the railroad to begin a retrograde movement.

For 31 miles the main line of the railroad had been retracked with American rails and the work of double-tracking it was just getting under way. The principal shops were at Matachin, with a capacity of overhauling five locomotives and 150 dump cars a month. The canal employees soon saw the caliber of man at their head by the way Mr. Stevens straightened out

the railroad tangle, for the freight began to move, lax methods were rooted out of the system, and the semblance of an efficient organization, operating along modern lines, appeared.

The Commission visited the Isthmus in July and August and with Mr. Stevens reached the conclusion that construction work should be reduced to a minimum, even to turning away employees, and all energies bent to building up a system of feeding and housing the men and their families. Preparatory work was given the right of way over construction, which accounts for the comparatively little excavation done under the Stevens régime. The general verdict was that the ground work done by Mr. Wallace was good, in spite of disorganized conditions, and that no insuperable obstacles stood in the way of building the canal. Delays in filling requisitions undoubtedly accounted for the lack of some of the equipment and supplies.

Mr. Wallace had left the following organization worked out on paper, with the explanation that large salaries had not attracted competent heads of departments, so that Mr. Stevens found many important positions unfilled:

The Department of Engineering and Construction was divided into five divisions, running from the Atlantic to the Pacific and known as the Colon, Chagres, Gamboa, Culebra, and La Boca Divisions.

Bureau of Personnel, Transportation and Quarters.
Bureau of Supplies.

Bureau of Waterworks, Sewers, and Roads.
Bureau of Machinery and Equipment.
Bureau of Architecture and Equipment.
Bureau of Meteorology and Hydraulics.
Bureau of Mapmaking and Printing.
Bureau of Communication.

There were 8,312 men in the department of engineering and construction, and other employees brought the total to 9,500, not including the Panama Railroad. Municipal improvements in Colon and Panama, and certain Canal Zone towns, were well under way. Effective progress had been made in the work of surveying the canal route, in making borings for lock sites, and in other engineering preliminaries. As noted, 741,644 yards had been excavated and nine steam shovels were at work. The 357 renovated French buildings and 48 new structures housed the employees, except those who provided shelter for themselves in Colon and Panama. There were no commissary and hotels.

On December 1, 1905, the Commission made its annual report to the President, containing Mr. Stevens' first review of the canal. Both he and the Commission pleaded for "a thorough business administration, unhampered by any tendency to technicalities, into which our public works sometimes drift." Like Mr. Wallace, Mr. Stevens found government red tape galling. Civil service and the eight-hour day were just as obnoxious, the Commission urging that "it is a mistake to handicap the construction of the Panama

Canal with any laws save those of police and sanitation."

An Executive Order had made the Civil Service cover the Canal Zone on November 15, 1904, but both Mr. Wallace and Mr. Stevens protested so earnestly against the restrictions of this order that on January 12, 1906, President Roosevelt removed all employees, except clerks, from the scope of the act, thus allowing Mr. Stevens to employ anyone he saw fit on any terms he chose. The eight-hour day restriction likewise was lifted, but agitation in the United States caused the President later to reimpose both limitations, with whatever increase in time and cost of constructing the canal they might involve.

The Americans had been in Panama more than a year, and still the type of canal to be built was undecided. Mr. Wallace's service had terminated and a full year of Mr. Stevens' administration before the choice was made. In the meantime, Mr. Stevens rapidly was rounding into shape an organization of workers, getting suitable quarters erected for the employees who were coming in large numbers, organizing the commissary and hotel systems, securing mechanical equipment, and bringing the transportation facilities to a satisfactory standard. Gov. Magoon simultaneously was organizing a civil government along the lines blazed by Gov. Davis. Police, courts, schools, fire departments, post offices, recreation clubhouses, churches, in short, duplicating on a scale suitable to the Canal Zone the civilization of the United States.

By June, 1906, the end of his first year as Chief Engineer, Mr. Stevens had made a remarkable showing in every phase of the work. There were 39 steam shovels at work as against 9 in 1905; the working force had increased to 23,901, of whom 3,264 were Americans. But, as showing how closely his efforts were concentrated on preparatory work, the total excavation for the year was only 1,499,562 yards, the highest figures for one month being in March, 1906, when 239,178 yards were removed.

Col. Gorgas and his sanitary department got on top of the yellow-fever epidemic in September, 1905, and in general so dominated the hitherto unhealthful Isthmus, that even the hostile press began to show a change in heart on this score, with the result that the immigration of workers largely increased. Recruiting agencies already had been opened in the West Indies, Europe, and the principal American cities. More than 12,000 men were imported in 1906 on contract with the Commission. The common labor was estimated by Mr. Stevens to be about 33 per cent as efficient as similar American labor. It was not until 1906 that the wives and families of the Americans began coming to the Canal Zone in considerable numbers, although there had been a heroic band of them throughout the trying days before the tropical terrors had been conquered.

Early in his connection with the canal, Mr. Stevens discovered that practically all the material in the Culebra cut would have to be blasted before it could be handled by the steam shovels. "The problem of Cu-

lebra cut," he wrote in the first annual report, "is one of transportation (including disposal) pure and simple." He had to be careful in selecting dumps so as to insure that they would not become an obstruction to any type of canal or route that might be selected. "As the gift of prophecy is withheld from us in these latter days, all we can do now is to make such arrangements as may look proper as far ahead as we can see," he wrote in his report of 1905 on the unsettled question of a sea-level or lock-type canal.

The high wages and salaries for which the Canal Zone is noted originated under Mr. Stevens. So bad a name had been given the Isthmus in the past that extra inducements had to be made to attract workers, free quarters, pay from 30% to 60% higher than in the United States, and a rate of $20 from New York to Colon on steamers operated by the government, with other perquisites, being some of the advertised attractions. Besides, in the latter part of Mr. Stevens' régime, the United States was enjoying unexampled prosperity, the palmy days before the panic of 1907. Mechanics and all kinds of workers could obtain employment at home at high wages and would not come to Panama unless for the unusual inducements enumerated, and, in addition, vacations with full pay, sick leave on pay, and cheap food and other necessaries.

The Battle of the Levels

Although the French had abandoned the idea of a sea-level canal in favor of a lock type, there still was

Clinedinst photo, Washington, D. C.

JOHN F. STEVENS.

a good deal of life in the idea among the American people. For one thing, a sea-level canal was so much more easily grasped by the popular mind, and then all engineers concede that it is the ideal canal where it is practicable. In Panama, the division of opinion arose over this point of practicability.

A sea-level canal aptly has been described as "a wide and deep passage navigable at all times, day or night, at all seasons and in all weathers, by all sorts and sizes of vessels." The lock type involves operations not readily portrayed to the lay mind, but eminently simple when seen in practical use. Popular opinion, and the daily and periodical press, divided and fought bitterly from the time the Canal Zone was taken until it finally was decided by Congress, and even then the sea-level advocates kept up an anvil chorus against the lock type.

The Walker Commission of 1901 had estimated the cost of a sea-level canal at $145,000,000. The Spooner act authorized $135,000,000 for any type that might be chosen, but leaned toward the lock type. The Commission of 1905 recommended a sea-level type to cost $230,500,000. Mr. Wallace later estimated the cost at sea-level at $300,000,000, exclusive of the $50,000,000 paid for the Canal Zone and French property.

That these American estimates should come, in the main, under the amount actually spent by the French, who little more than scraped the surface, shows, for one thing, that the Americans believed there had been gross extravagance and inefficiency in the French oper-

ations, and for another thing, that the Americans had no adequate grasp upon the task they were undertaking. This same insufficiency of estimates continued until 1908, when Col. Goethals faced the situation frankly and announced the cost for a lock type to be $375,000,000, which was far ahead of the highest estimate for a sea-level canal. In 1909, Col. Goethals said a sea-level canal would cost $563,000,000 and take six years longer to build than a lock canal, which was before the slides in the Culebra cut became so formidable and a sea-level canal had been shown thereby to be all but impossible. It is probable that a sea-level canal would cost around a billion dollars, and take from ten to twenty years longer to build, if engineers should now decide it practicable.

President Roosevelt took a characteristic step to end the dispute. On June 24, 1905, a few days before the appointment of Mr. Stevens as Chief Engineer, he named the following International Board of Advisory Engineers to recommend a type of canal:

Maj.-Gen. George W. Davis, U. S. A., *Chairman,*

Capt. John C. Oakes, U. S. A., Corps of Engineers, *Secretary,*

Brig.-Gen. Henry L. Abbott, U. S. A., retired,

Adolph Guerard, Inspector-General of Public Works, France,

Edouard M. Quellenec, Consulting Engineer, Suez Canal,

Henry Hunter, Engineer of Manchester Canal, England,

Herr Eugene Tincauser, Engineer on Kiel Canal, Germany,

J. W. Welcker, Engineer Dyke System, Holland,

Isham Randolph, Chief Engineer, Chicago Drainage Canal,

Frederick P. Stearns, Hydraulic Engineer, Boston,

William H. Burr, Consulting Engineer, New York,

Joseph Ripley, Chief Engineer, Sault Ste. Marie Canal,

Alfred Noble, Chief of Pennsylvania R. R. Improvements, N. Y. C.,

William B. Parsons, Chief Engineer, Subway System, New York.

Out of this number, five were foreigners and the remainder Americans. The Board visited the Isthmus in October, 1905, and reported to the President on January 10, 1906. The majority, composed of eight engineers, and comprising all of the foreigners, recommended a sea-level canal. Messrs. Davis, Burr, and Parsons were the three Americans who signed the majority report. The minority of five Americans recommended a lock-type canal with a lake at 85 feet above sea-level formed by a dam across the Chagres River at Gatun. They estimated the excavation at 103,795,000 cubic yards, and the cost, exclusive of sanitation and civil government, at $139,705,200. Nine years, or until 1915, was the time estimated for completing the canal. There were to be three locks in flight at Gatun, each 95 by 900 feet usable dimensions, and on the Pacific side, one lock at Pedro

Miguel, and two at La Boca, at the entrance, the distance between Pedro Miguel and La Boca, 8 miles, to be a second artificial lake. The Culebra cut was to be 200 feet wide for 5 miles and 300 feet wide for 4 miles.

Chief Engineer Stevens and all but one member of the Commission concurred in the minority report. Secretary Taft's visits to the Isthmus had converted him to the lock type, and President Roosevelt consistently had favored it.

The situation was one where the choice would be decided by the weight the President should throw to either report. To reject the majority report favoring a sea-level canal, and to advocate the minority report for a lock-type canal, was a responsibility of unusual magnitude for an Executive who professed to have no technical engineering knowledge. Yet President Roosevelt made the momentous decision without hesitation, sending a strong message recommending the minority report. It was, perhaps, the greatest crisis in the history of the project, and the American people have to thank his sound judgment in preventing a sea-level experiment that, undoubtedly, in the light of recent years, would have exhausted the patience and maybe the finances of the nation.

Congress debated the issue until June 21st, when the Senate by the close vote of 36 to 31 decided for a lock type, and on June 28th, the House concurred, the bill becoming law on June 29, 1906. The sea-level advocates were beaten, but they watched operations sullenly and flared up into hot criticism fre-

quently, with dismal prophecies of the impending collapse of the lock canal.

Of the three Chief Engineers who have directed the construction of the canal, Mr. Wallace alone favored the sea-level plan. He uniformly opposed a dam at Gatun, expressing the opinion that there was not a foundation at that point for so heavy a structure, nor did he believe from his investigations that the earth there would support the great locks contemplated in the minority report. Any type of canal, he reasoned, which would require years to repair a break was inadvisable, and even a lock type should be convertible to a sea-level canal, if such action should appear desirable. Messrs. Stevens and Goethals were equally unwavering in their advocacy of a lock canal.

Two years and two months had passed from the time the Americans came to Panama, in May, 1904, to July 1, 1906, before this decision was made, and at last the Commission knew what plan of canal was to be followed. In September, 1906, Mr. Stevens started the excavations in the sites for the Gatun locks, the Pedro Miguel lock, and the Gatun Dam Spillway. Surveys were begun for relocating the Panama Railroad which, for a considerable distance, would be swallowed up by the completed canal. The fifteen months' preparatory work was beginning to tell in the increased excavations in the Culebra cut as the organization was getting its stride. Commissaries, which sold everything the canal employee needed, were in operation in the principal towns, the hotels for the bachelors were well organized, quarters had

been erected until all were housed, though at times rather crowded, machinery, supplies, and equipment were on hand, or ordered, to the extent of 80 per cent of what would be needed to complete the canal, health conditions were admirable, and the whole situation was shaping for the real work of building the canal.

President Roosevelt paid the Canal Zone a visit in November, 1906. It was a trip of exploration for him, and the way he ignored the formal plans for his entertainment delighted the employees. Subordinate officials were rather anxious that he should inspect just the things they had spick and span for him to inspect, but from the time he landed at Colon, where he jumped on a horse instead of into a waiting carriage and rode down the unpaved side streets, noting the mud and unfinished improvements, until he ate in the line hotels with the dirt-covered employees, inspected the kitchens and quarters, and had nosed in and out of every part of the canal, he led them a merry chase. The enthusiasm for the "daddy" of the project was boundless, and the shortcomings he noted resulted in better conditions of employment for the men.

One evidence of the growing luxury of living conditions in the Canal Zone was the installation on January 1, 1907, of electric lights in the quarters of the married and bachelor employees at Empire and Culebra. Other towns soon were furnished with electricity. The first public school had been opened a year before this event, or on January 2, 1906. Gov. Magoon, on September 25, 1906, had been transferred

to Cuba by the President, occasioning the first break in the Shonts Commission. The summer and fall of 1906 and the winter of 1907 saw another great controversy raging around the canal, which, like the battle of the levels, was to be decided arbitrarily by President Roosevelt.

The Contract Plan

Chairman Shonts long had entertained the opinion that the canal should be constructed by private contractors. He pressed the plan so vigorously, and the popular opinion of the inefficiency of the government was so strong, that the President authorized Secretary Taft to ask for bids on October 9, 1906.

By this time conditions had so improved in the Canal Zone that the employees viewed the assumption of control by contractors as likely to militate against their interests. Mr. Stevens was making admirable headway, both in the creation of an effective organization and the physical equipment to do the actual work of construction. He had little enough patience with governmental methods, but on the point of securing competent workers, which Mr. Shonts seemed to think the government could not do so speedily and well as a contractor, Mr. Stevens said in his report of 1905: "The very liberal and wise policy which the Commission is carrying out in its care of its employees and in its treatment of them in every way must, after patient and careful selection, result in a personnel entirely capable of producing good results."

The plan Mr. Shonts advanced for turning the job

over to a private contractor, left in the hands of the government the last word on every vital question that might arise. Viewed to-day, the terms of the invitation for bids seem to have been drawn with so much rigidity as completely to have robbed any contractor of the very flexibility of action which appeared to be the main drawback of a government enterprise. The government was to decide upon the cost and plans and the contractor was to receive a percentage of that amount for his services. Civil government and sanitation were to remain in the hands of the government.

It is safe to assume that had the plan been adopted, it would have broken down in less than three months, because the contractor either would have settled to the mere foremanship of the job, with the government engineers the court of last resort on all issues, or he would have asserted an independence of judgment and action which the terms of the contract did not permit. Either result would have been disastrous to the canal project.

Those who favored the contract plan had some considerations which were potent with them, but which they did not shout from the housetops. They knew that the terms of the contract on which bids were invited practically reduced the contractor to the position of superintendent, but by nominally placing the work in his hands they would get the private contractor's freedom of action as to hours of work, standard of wages, fitness of employees, and cheapness of markets for materials. In other words, so long as the

government itself built the canal, the eight-hour day, civil-service regulations, and the whole web of official procedure that enveloped the undertaking, would be operative. The contract plan offered a neat way of sidestepping these cumbersome conditions of doing business.

Mr. Wallace heartily favored the contract plan, expressing his belief in "the utter impossibility of the United States Government carrying on a constructive enterprise in a common sense, businesslike manner." Whatever his attitude at first, toward the last Mr. Stevens opposed the contract plan, as he believed that the work he had done in the Canal Zone was efficient, and if a little relaxation in red tape was indulged, the canal could be built more advantageously by the Government.

Bids for constructing the canal by private contract were opened at Washington on January 12, 1907, and rejected on the ground that they failed to meet the requirements of the government. The Oliver-Bangs syndicate was nearest in its bid to the specifications. The real reason for rejecting the bids was that both the country and the administration had undergone a change of heart as to the wisdom of the contract plan.

Another epoch in the life of the canal project was marked by the President's action in definitely committing the enterprise to direct government supervision. Chairman Shonts resigned, effective March 4, 1907. An executive order then consolidated the offices of Chairman and Chief Engineer in Mr. Stevens. On March 16th the remainder of the Commission, except

Col. Gorgas, resigned, to be followed on April 1st by the resignation of Chief Engineer Stevens. His resignation came like a sickening accident to the canal employees. "The Chief," as he was called familiarly, had established himself firmly in their minds and hearts as a thoroughly competent engineer and just administrator. No official explanation of the motive for his quitting had been made, but the general understanding is that he opposed the assignment of government engineers to the Commission as likely to create friction with civilian engineers and partly to a stiff communication he sent the President on the limitations of red tape and governmental methods generally. His departure was featured by a remarkable demonstration at Colon, when he was presented with a gold watch, a diamond ring, and a silver service by the employees, who did not restrain their emotion at his loss.

Mr. Stevens was not soured by the termination of his services as Chief Engineer. His faith in the ultimate success of the project has remained unshaken, and in the *Engineering News* of December 31, 1908, a year and three quarters after his resignation, he wrote that the public criticism of the locks and dams was erroneous, and advised that Col. Goethals be backed up in his admirable efforts. The greatest tribute to his work as Chief Engineer is found in the fact that the organization of employees was so thorough and the foundational work so well done that the enterprise was not harmed by a change in managing directors.

CHAPTER XIII

THE CANAL UNDER GOETHALS

PRESIDENT ROOSEVELT had at last found public sentiment educated to the point where the canal could be put exclusively in the hands of government engineers, following the untimely resignation of Mr. Wallace, the belief that private interests were seeking to grab the project, and the loss of Mr. Stevens. It had taken three years to reach this attitude. The personnel of the third Commission he appointed, on April 1, 1907, was as follows:

LIEUT.-COL. GEORGE W. GOETHALS, *Chairman and Chief Engineer,*
MAJ. D. D. GAILLARD, U. S. A.,
MAJ. WILLIAM L. SIBERT, U. S. A.,
MR. H. H. ROUSSEAU, U. S. N.,
COL. W. C. GORGAS, U. S. A., *Medical Corps,*
MR. J. C. S. BLACKBURN,
MR. JACKSON SMITH,
MR. JOSEPH BUCKLIN BISHOP, *Secretary.*

The President also took advantage of the reorganization of the Commission to further consolidate power in the Chairman. Not only was Col. Goethals made Chairman of the Isthmian Canal Commission, and Chief Engineer of the Panama Canal, but the executive power in the Canal Zone, formerly exer-

cised by the Governor, was vested in him, as well as the Presidency of the Panama Railroad Company, thus making every official and employee, and the members of the Commission, subordinate to him.

In former years the Governor had exercised extensive and supreme powers within his sphere, ranking higher than the Chief Engineer. Where the Chairman, Chief Engineer, and Governor had rival powers, friction was sure to develop, and did so develop. Under the new order the Governor was reduced to the title of Head of the Department of Civil Administration, reporting to the Chairman, as did the Chief Sanitary Officer and Division Engineers. Thus the former concentration of the power of a Commission of seven members into an Executive Committee of three, was still further concentrated into one man and so gave Col. Goethals the absolute authority he ever since has exercised in the Canal Zone, acknowledging only the Secretary of War and the President as his superiors.

Mr. Jackson Smith's appointment to the Commission is the only instance of a civilian coming to the Canal Zone as an employee and attaining to the position of Commissioner. He had shown such remarkable ability as the head of the Bureau of Labor, Quarters, and Subsistence, in recruiting workers, housing them and supplying them with food, that his services were recognized by elevation to the Commission. Mr. Blackburn, of Kentucky, was the head of the Department of Civil Administration, and Mr. Bishop was to edit a weekly Canal Record, the official Commission

publication, the first issue of which appeared on September 4, 1907, and every Wednesday since. Five of the new Commissioners and the Secretary have been on the job continuously from that day to this, the changes coming in the other two members on September 14, 1908, when Mr. Smith resigned and was succeeded by Lieut.-Col. H. F. Hodges, and Mr. Blackburn being succeeded by Mr. Maurice H. Thatcher, on April 12, 1910.

Col. Goethals appreciated the feeling the employees had over the prospect of army engineers for directors of the enterprise, and in his first speech in the Canal Zone dispelled the idea of militarism in the canal management. He promised a fair hearing to every man with a grievance, the manner in which he carried out this promise being one of the distinctively great qualities he later revealed as an administrator. Few persons in the Canal Zone had heard of Col. Goethals before his appointment as Chief Engineer. He had visited the Isthmus in 1905 to study it with a view of recommending plans for fortifications, but the employees who had been with the job then scarcely were impressed by his presence. Yet, his previous experience had qualified him ideally for the important work now in hand. He had been building locks and dams, had been Chief of Engineers in the Spanish-American War, was a graduate of and had taught in West Point, and had seen other construction experience that made him at home in any kind of work the canal should require. Messrs. Stevens and Wallace lacked his knowledge of lock building, and they lacked the

military point of view which was to become essential in directing the fortification work, and the general policy of treating the Canal Zone as a military reservation, even though the project is neutral and open to the nations of the world.

Looking back from this perspective of years it seems fortuitous that the canal has had the impress of both civilian and army engineers. When Mr. Stevens left, the enterprise was ready for just the treatment it has received under Col. Goethals, which is, that we are not investing $375,000,000 as a mere adjunct to commerce, but as a means of national defense vitally necessary. The military coloring Col. Goethals has given the canal will not impair its utility in the world's trade, yet it will keep it ready for the emergencies of war in a manner that the civilian view point hardly could have been expected to produce.

Contrast, for a moment, the situation as faced by Col. Goethals with that faced by Mr. Stevens in 1905. In 1907, fire was under the boiler and steam was up. When Mr. Stevens relinquished the throttle, the army of workers had begun to come close to the million mark in monthly excavations in the Culebra cut. There were 63 steam shovels at work on the canal; 100 French and 184 American locomotives, and 2,700 cars of all kinds were in use; the Panama Railroad had been double-tracked throughout, and the mileage in the Culebra cut and elsewhere brought up to 106-.78 miles; 18 Lidgerwood unloaders, 13 bank spreaders, 33 unloading plows, 3 track shifters and 7 pile

drivers were in service; the machine shops at Gorgona and Empire were equipped for any kind of repair work or original construction.

There were approximately 30,000 employees, and the recruiting agencies in Europe, the West Indies, and the United States constantly were sending additions. Quarters for employees, office buildings, and all other structures consisted of 2,009 buildings of American design, and 1,536 remodeled French buildings. The commissary for supplying food, clothing, and general merchandise to employees was organized and had branches in seven Canal Zone towns. There were fifteen hotels in operation for bachelor employees and four recreation clubhouses had been constructed, beside church and lodge buildings. Twenty-four public schools afforded educational facilities to the Canal Zone children. The police system, the courts, post offices, and fire departments were thoroughly organized. In short, the preparatory stage of the canal had passed and the constructive stage had begun.

As compared with the total excavation required for the completed canal, in round numbers 221,000,000 yards, the record made by Mr. Stevens, in removing from the Culebra cut during the twenty-one months he was Chief Engineer, 5,073,098 yards, is not significant. The construction of the canal distinctly is the work of the Goethals administration; still, the preparatory work had to be done because, as Col. Goethals himself states:

"It was only after these various yet necessary adjuncts had been provided and the forces for their

operation were organized that the principal work in hand—the building of the canal—could be pushed forward with any hope of success, and too much praise cannot be given those who conceived and established them in a working condition."

Necessarily, all the basic work accomplished under Wallace and Stevens is lost sight of in view of the magnificent superstructure erected under Col. Goethals. The modern sightseer has nothing to remind him of the wretched conditions of the first two years, the battle with disease, the arduous labor of creating in the jungle a duplicate American civilization, the tantalizing struggle with government red tape before a stick of timber, a pound of iron, a shipment of food, or an efficient workman could be secured.

The first vivid impression to-day upon the tourist viewing the colossal locks and the artificial canyon called the Culebra cut, the beautiful towns, and the whole paraphernalia of a well-ordered civil government is similar to that experienced upon the first sight of Niagara Falls, with this exception: The Panama Canal is the work of man, and the responsibility for it may be fixed. An outburst of praise is the spontaneous result, and Col. Goethals, being the visible head of the project, naturally bears the brunt of this admiration. Yet, excluding the construction work, all the collective activities, such as feeding and housing and providing for the needs of the army of employees, as well as the whole civil government, was the work of the Stevens and Wallace administrations.

Col. George W. Goethals.

Col. Goethals simply has enlarged the organizations they left.

Perhaps the chief reason that Col. Goethals so generally is accepted as the sole genius of the canal is found in the fact that he stuck to the job which two others had abandoned. Justice, however, is not wholly served by this consideration. A simile may be found in the task of breaking a broncho. The canal job threw both Wallace and Stevens and then Goethals stuck in the saddle. But the energy that the broncho spent to dismount the first two riders so weakened him that by the time the third was in the saddle he was conquerable. The third rider may have been no better than the two who were thrown, and their efforts undoubtedly paved the way for his success.

Col. Goethals deserves the admiration that his service on the canal has evoked, but the generality of writers, looking at what exists to-day and heedless of the beginnings of the task, lose their perspective and commonly fall into the error of ignoring the very remarkable and wholly vital preparatory work under John F. Stevens. This writer believes that if Col. Goethals had been selected in 1904, there only would have been one Chief Engineer of the canal, barring his death, so eminent are the abilities of the army engineer, but candor requires the statement that he assumed control at a time when conditions were soft as compared with the early stages of the project.

President Roosevelt had selected in Messrs. Gaillard, Sibert, Rousseau, and later, Hodges, engineers

of exceptional ability, who, with S. B. Williamson, picked by Col. Goethals, demonstrated capacities which in a large measure account for the splendid progress of the Goethals administration. Any one of them would have been available for the highest position in the organization.

It would be erroneous to assume that Col. Goethals had nothing to do but sit back and watch the signals on the main line of canal construction, as indicated by his predecessors. The decks, indeed, had been cleared for action and the blue-prints nicely finished and tied with ribbon, but the real struggle was just beginning. He had the tools for the job placed in his hands, but their skillful use devolved entirely upon him. Besides, changes were made in the original plans and unanticipated problems arose, which made Col. Goethals' direction of the enterprise in the highest degree complex and exceptional.

The first annual report of the Commission, to be written as of June 30th, the end of the government's fiscal year, was issued by Col. Goethals in 1907, three months after Mr. Stevens resigned. The President had asked Col. Goethals to report on the contract plan after an inspection of the canal, and this masterly argument against turning it over to private contractors is the report's most notable feature, aside from its unusual comprehensiveness. Incidentally, the argument is a high tribute to the work of Mr. Stevens.

Col. Goethals pointed out that the canal required special equipment which would be useless to a contractor after its completion, and therefore could be

bought just as cheaply by the government; that the government had had more experience in lock building than any contractor, and had had sufficient experience in dredging and excavating to insure economy. When the profits a contractor would make were deducted, the government could equal his efficiency. He pointed to the Congressional Library at Washington as an example of work done satisfactorily by the government. No contractor had an organization that could cover all phases of the canal, and the government already had as good an organization as any contractor could get. The French had tried the contract system, antagonizing labor thereby, and Italy already had served notice that its citizens could not work in the Canal Zone if the government abandoned the job. Finally, endless friction between government inspectors and the contractor would result, and on the side of civil government and sanitation the contractor could not possibly equal the efficiency of the government.

Taking a survey of the conditions when he took charge, Col. Goethals found that 80 per cent of the plant for finishing the canal was on the ground or ordered. The preliminary work for relocating the Panama Railroad had been done, and actual construction of the new line was begun in June, 1907, shortly after his arrival. Excavations in the lock sites were uncompleted, and it was two years later, in 1909, before any concrete was laid. In April, the month he arrived, nearly 900,000 yards were removed from the Culebra cut, the best month's work to that date. By

December, 1907, the million mark for the Cut was passed and never has been lowered except for one month, May, 1908. Dredging in the Atlantic and Pacific entrances of the canal had gone ahead steadily, though not extensively, the amount removed in the Atlantic entrance being 1,732,712 yards, and in the Pacific entrance, 1,956,895 yards, from 1904 to April 1, 1907. Less than 6,000,000 yards had been removed from the Culebra cut by both Wallace and Stevens.

In August, four months after Col. Goethals arrived, the organization in the department of construction and engineering had developed such a momentum that it was necessary to ask authority from the President to exceed the regular appropriation by $8,000,000 for the fiscal year to end in June, 1908. This is additional evidence of the efficiency of the preparatory work under Mr. Stevens.

The fall of 1907 and the month of October presented a new problem in the canal construction which ever since has been one of the most formidable and uncertain factors in the project. A slide began at Cucaracha on the east side of the Cut near the town of Culebra and suddenly filled the Cut, closing it for transportation. In 1884, the French had noted this earth movement, and during Col. Goethals' first years on the canal it involved an area of forty-seven acres. Before dirt trains could move through the Cut, steam shovels had to work night and day for several weeks, and from that time onward the slides have been the bugbear of the organization, not because they were insuperable, but from the extra work they involved

and the possibility that they might delay the completion of the project. In the closing days the slides are still the unknown factor.

Right then it was realized that the canal involved more excavation than the minority of the Board of Advisory Engineers had estimated. Several important changes in the plans for the canal came within the first eighteen months of the Goethals administration to make the job far more stupendous than contemplated in the plans of 1906. Col. Goethals recommended, and President Roosevelt approved on December 20, 1907, a change in the location of two of the Pacific locks. The revised plans changed two locks from La Boca, on the Pacific coast, to Miraflores, about seven miles inland, which not only would make them safe from bombardment, but was a more practicable engineering plan. A mile and a half farther inland were the Pedro Miguel locks, which would raise ships the final height to the great Gatun Lake, at its Pacific terminal, and between the Pedro Miguel and Miraflores locks was a small artificial lake. From Miraflores to the Pacific, a sea-level channel 500 feet wide was to be dug.

Another change in the plans was approved by the President on recommendations by the Navy Board, on January 15, 1908. The locks were ordered enlarged from 95 by 900 feet to 110 by 1,000 feet, usable dimensions, to meet the anticipated increase in the size of commercial and war vessels. Col. Goethals did not think a width of 110 feet necessary, favoring 100 feet width, but his judgment in this

instance has proved to be wrong, as the latest Argentine battleship is 98 feet wide, leaving only 12 feet surplus in the width of the locks, at 110 feet. The *Pennsylvania* of our Navy will be 97 feet wide, leaving 13 feet, or 6½ feet on each side of the ship in the locks. The *Imperator*, the latest giant of the Hamburg-American fleet, is 96 feet wide and 900 feet long, so that it appears that the locks may become too narrow before they become too short. The cost of the locks was increased $5,000,000 by the change in plans.

A third vital change in the original plans came on October 23, 1908, when the President authorized the widening of the Culebra cut for five miles from 200 feet to 300 feet at the bottom. This would enable ships to pass going in opposite directions anywhere in the Cut, and increased the cost of this part of the canal by $14,000,000. Since these three important changes there have been no substantial changes in the canal plans, except the decrease in the proposed height of the huge Gatun dam. Additional excavation to the extent of 70,871,594 cubic yards was necessitated by the new plans over the estimate of 103,795,000 yards made in 1906, or a total of 174,666,594 yards for the completed canal. But slides that later developed, and further changes in the plans since 1908 have added 47,000,000 yards to that total, bringing it up to 221,000,000 yards. Thus Col. Goethals has had to dig more than twice as much dirt as Mr. Stevens expected to take out, and is doing it in less time than was estimated for the original yardage! The original canal of 103,795,000 yards was dug by the Americans

by April 6, 1910, six years after work began, and two years and a half of that time had been spent in preparatory work.

Basing his figures on the revised plans, Col. Goethals in 1908 issued the following estimate of the cost of the Panama Canal:

ATLANTIC DIVISION—7 MILES

Breakwater in Limon Bay	$11,432,000
From Caribbean Sea, channel to Gatun Locks	17,736,000
Gatun Locks, three twin locks	25,824,000
Gatun Dam	13,572,000
	$68,564,000

CENTRAL DIVISION—32 MILES

Channel from Gatun Locks to Bas Obispo	$7,977,000
Culebra Cut, Nine Miles, Bas Obispo to Pedro Miguel Lock	80,481,000
	$88,458,000

PACIFIC DIVISION—8 MILES

Pedro Miguel Lock	$12,693,000
Pedro Miguel Dam	251,000
Miraflores Locks	19,715,000
Miraflores Dam	2,156,000
Channel, Pedro Miguel to Pacific	13,170,000
	$47,985,000

New Panama Railroad	$8,164,000
Land Damages	500,000

General Items

Municipal Improvements	$12,114,000
Buildings	14,651,000
General Expenses, Salaries, Subsistence, etc.	23,730,000
Loans to P. R. R.	8,300,000
Contingencies	20,000,000
Lighthouses, Ships, Wharves	3,850,000
Double-tracking, Land and Stock Purchases	1,450,000
	$84,095,000
Grand Total Cost of Construction	$297,766,000

All Other Items

Sanitation	$20,053,000
Civil Administration	7,382,000
Paid for French Property	40,000,000
Paid for Canal Zone	10,000,000
	$77,435,000
Total Cost for Completed Canal	$375,201,000

Beginning July 1, 1908, Col. Goethals initiated changes in the organization, which was to be the final one for the canal. The Department of Engineering and Construction was divided into three grand divi-

sions, to be known as the Atlantic, Central, and Pacific. The Atlantic division comprised that part of the canal which extended from deep water in the Caribbean Sea to, and including, the Gatun locks and dam, about seven miles of the canal. The Central division comprised the channel through the Chagres River valley from the Gatun Locks to Bas Obispo, where the Culebra cut began, and for nine miles through the continental divide to the Pedro Miguel Lock, about thirty-two miles of the canal. The Pacific division comprised the Pedro Miguel Lock and Dam, the short channel to the Miraflores Locks and Dam, and including those features, and the channel to deep water in the Pacific, about eight miles of the canal.

Of the forty-seven miles of the canal proper, the Central division had the greatest mileage, its construction was to be the costliest and the material handled to be far in excess of either of the other two divisions. It is in the Central division that the main excavation of the canal has been made, as the mountain chain had to be pierced with a cut, the bottom of which would be only forty feet above sea-level, necessitating digging down from the highest point on the surface, a depth of 272 feet, between Gold and Contractor's hills. The French dug down 161 feet at this point, but not so wide as the American plans required so that considerably more than 111 feet depth remained for the Americans to dig. From this highest point the mountains slope toward the Atlantic and Pacific with a consequent lessening of the depth of the excavations

to reach the proposed bottom of the canal. Practically all the material had to be blasted before removal.

Since 1908 the organization has remained unchanged as to the heads of the divisions in the department of engineering and construction. As finally designed by Col. Goethals, the organization of the canal forces is as follows, with the incumbents as of July 1, 1912:

ENGINEERING AND CONSTRUCTION

COL. GEO. W. GOETHALS, *Chairman* and Chief Engineer, Culebra.

COL. H. F. HODGES, Assistant Chief Engineer, in charge of Lock and Dam construction, Culebra.

CIVIL ENGINEER H. H. ROUSSEAU, Assistant to the Chief Engineer, in charge of mechanical equipment and supervision of expenditures and estimates, Culebra.

LIEUT.-COL. D. D. GAILLARD, Engineer, Central Division, Empire.

LIEUT.-COL. WILLIAM L. SIBERT, Engineer, Atlantic Division, Gatun,

S. B. WILLIAMSON, Engineer, Pacific Division, Corozal,

A. L. ROBINSON, Superintendent, Mechanical Division, Gorgona.

ALL OTHER DEPARTMENTS

LIEUT.-COL. EUGENE T. WILSON, Subsistence Officer, Cristobal,

COL. C. A. DEVOL, Chief Quartermaster, Culebra,