# CHAPTER XXXVI

## THE RAILROAD MEN AT PANAMA*

MR. SHONTS BECOMES CHAIRMAN OF THE COMMISSION—HE SECURES JOHN F. STEVENS AS CHIEF ENGINEER—RAILROAD MEN AS HEADS OF DEPARTMENTS—DEADLY CLIMATIC CONDITIONS—MAKING THE ZONE HABITABLE—FRENCH AND AMERICAN DEATH-RATES COMPARED—SOLUTION OF THE LABOR PROBLEM—HOUSING AND FEEDING THE TROPICAL ARMY—WHY A LOCK CANAL WAS CONSTRUCTED—ORGANIZATION OF THE FORCES.

BY THEODORE P. SHONTS

IT was toward the latter part of March, 1905, while on a cruise among the West Indies on board the United States dispatch-boat *Dolphin*, with Senator Hale, of Maine, and Representatives Cannon of Illinois and Meyer of Louisiana, as guests of the late Paul Morton, Secretary of the Navy, that I received a cablegram from President Roosevelt asking me to accept the chairmanship of the commission then in process of formation to construct the canal across the Isthmus of Panama. The president's message was delivered on board the *Dolphin* at Guantanamo, our naval station on the southeastern coast of Cuba, and I had time to consider the proposition during the several days that elapsed before we went ashore at Fernandina, Florida, to take train for Washington. Knowing as little about the big project at Panama as anyone who kept track of current events at all, I was nevertheless aware that the first commission, of which Rear-Admiral Walker was chairman, had not—to quote Secretary of War Taft—"so developed itself into an executive body as to give hope that it might be used successfully as an instrument for carrying on the immense executive burden involved in the construction of the canal." I recognized the shrewdness and wisdom of the President in choosing a railroad man to shoulder the "executive burden," for, after all, the big problem of the canal was one of transportation—the moving of the excavated material from the cut to the spill banks, and the moving of sand, rock, cement, and iron to the points for the location of the locks along the route. The engineering problem was one of magnitude rather than complexity. If the project had been to do a similar job in a developed country and a temperate climate, it would have been attended with no especial difficulties; the fact that conditions approximating modern development had to be brought into existence in a tropical wilderness two thousand miles from the base of supplies for the work itself and the men performing it, was what made it interesting.

While the acceptance of the President's offer meant material sacrifice, I considered it a patriotic duty to accept, providing only that certain views I held, whereby I believed I might achieve success, were met. And I own that I felt some pride in being chosen for an important part in a historic enterprise fraught with such enormous potentialities to the entire world and for all time. The views referred to I set forth to Mr. Roosevelt in his office at the White House, the day after my arrival in Washington from Fernandina.

"Mr. President," I said to him, "I have an idea that when you learn the conditions under which I am willing to become chairman of the Isthmian Commission you may withdraw your offer. With a body composed of so many different members with diversified duties that are likely to conflict on occasion, there is bound to be

*Courtesy of the North American Review.

friction so long as responsibility is divided. I should not care to accept the chairmanship of this commission, therefore, unless it is understood that I am to have absolute authority as to both men and measures in the work of the construction of the canal—subject to your approval, of course."

Mr. Roosevelt's response was characteristic. He rose and threw open the door of his office to the newspaper correspondents, whom he had summoned for the purpose of acquainting them with my decision—provided it should be acceptance of the post he had offered.

"Gentlemen," he said, "allow me to introduce to you the chairman of the Isthmian Commission, who is to have absolute control of the construction of the Panama Canal."

It was a propitious outcome of my acquaintance among railroad officials that I was able to put my hands upon men especially fitted to become heads of the various departments of the canal work. Following the resignation of John F. Wallace as chief engineer, I had the good fortune in June to secure in his place John F. Stevens. Mr. Stevens had been active in the construction of the Great Northern Railway, and afterward in its operation. He severed his connection with the Rock Island Railroad as vice-president in charge of operation to accept the position of chief engineer of the canal. On his resigning this position, after having succeeded me as chairman of the Isthmian Commission in March, 1907, he became vice-president in charge of operation maintenance of the New Haven lines, and subsequently president of a railroad constructed by him across the state of Oregon for the Hill system. Mr. Stevens's first assistant at Panama was J. G. Sullivan, who is now chief engineer of the Canadian Pacific Railroad. David W. Ross, who had been purchasing agent and afterward superintendent of transportation of the Illinois Central Railroad, left the latter position to become the head of the canal's purchasing department, and is at present vice-president of the Interborough Rapid Transit Company, of New York. Edward J. Williams, paymaster of the Chicago & Northwestern Railroad, became disbursing officer on the isthmus, and up to date has paid out $250,000,000 without an error. From the Chicago & Rock Island road, where he was assistant general manager, came W. G. Bierd to take charge as general superintendent of the operation of the Panama Railroad. The Oregon Railway & Navigation Company, a part of the Harriman system, contributed its general auditor, E. S. Benson, who assumed control of the accounting department of the canal construction. W. G. Tubby, for years general storekeeper of the Great Northern Railroad, left that position to perform the same duties at Panama. Jackson Smith, who, as a railroad contractor and in other capacities, had had a very extensive experience with construction labor, took charge of the department of labor and quarters. Richard Reid Rogers, who was general counsel to the Isthmian Commission and the Panama Railroad, still holds the latter position, and is also general counsel to the Interborough Rapid Transit Company. W. Leon Pepperman, who had formerly been assistant chief of the bureau of insular affairs at Washington, was chief of the office of administration of the commission, and to-day holds the position of assistant to the president of the Interborough Rapid Transit Company.

Colonel W. C. Gorgas was at Panama when I became chairman of the Isthmian Commission, and his splendid services as sanitation officer had given him an international reputation. Charles E. Magoon was the civil governor of the Canal Zone and a member of the commission. The other members were Mr. Stevens, Rear-Admiral Mordecai T. Endicott of the navy, General Peter C. Hains, a retired officer of the army, Colonel Oswald H. Ernst, of the engineer corps of the army, and Benjamin M. Harrod, all capable and efficient men.

The magnitude of our task did not diminish as we became familiar with details. Our first proposition was the creation of a modern state in a ten by fifty mile stretch of tropical wilderness, scourged by deadly fevers and pestilence, and practically uninhabitable by natives of other climes. Obviously it would be a criminal as well as an uneconomic policy to begin the actual construction of the canal while conditions were such that the laborer did his work at the peril of his life; and, in spite of the fact that the Fourth Estate of America was unanimous in the view that because we did not at once begin to "make the dirt fly" we were wasting time, we adhered to the determination to render the isthmus habitable before beginning to dig, rather than bring men there to die.

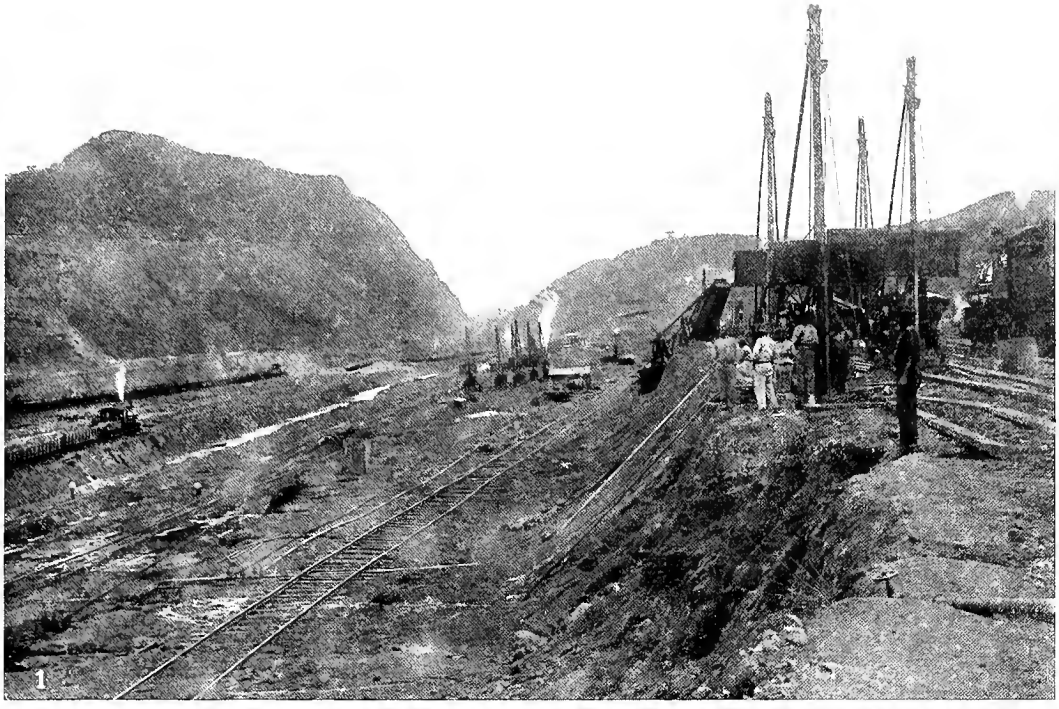
The commission was also charged with the making of an investigation as to the respective merits of a sea-level or a lock canal at Panama; with the designing, purchase, and installation of the power and machinery with which the great ditch was to be dug; with the determining of the character of the labor to be employed, and recruiting and carrying it to the isthmus; and with the rehabilitation of the Panama Railroad, which was an instrument essential to the construction of the canal.

When the commission took charge at Panama there were almost as many of the white employees leaving the isthmus as were coming there. In a recent address before the Oregon Society of Engineers, Mr. Stevens thus describes the situation:

"When I reached Panama in July, 1905, conditions could have been much worse, but they were bad enough. No real start had been made at any effective work on the canal proper, no adequate organization had been effected, sanitary reforms were really just beginning, little new plant had been provided, and little that was absolutely necessary had been ordered. In the organization that existed no cooperation was apparent, and no systematic plans, as far as I could discover, had been formulated toward the carrying out of the work along the lines promising any degree of success. And—worse than all—over and above, in the diseased imagination of the disjointed force of white employees, hovered the angel of death in the shape of yellow fever, a number of cases of which were then prevailing, and from which several deaths had occurred. What many of the intelligent men seemed to expect was an order from Washington to abandon the work and go home. To provide housing for this army, to properly feed, to instil into them faith in the ultimate success of the work, to weed out the faint-hearted and incompetent, to create an organization fitted to undertake the tremendous work, and to fill its ranks with the proper material was a task of heroic proportions. No one will ever know, no one can realize, the call on mind and body which was made upon a few for weary months while all the necessary preliminary work was being planned and carried forward, and no attempt was or could be made to carry on actual construction until such preliminaries were well at hand. And the only gleams of light and encouragement were the weekly arrivals of newspapers from the States, criticizing and complaining because the dirt was not flying."

In order to make the Canal Zone a place fit to live and work in, there were three fundamental tasks which had to be performed in advance of all others—the thorough sanitation of the isthmus; the provision of suitable habitations for all classes of employees, from heads of departments to negro laborers; arrangement for a food-supply which would afford to all employees an opportunity to obtain meat and vegetables at reasonable cost. When the United States began the work of sanitation there were no systems of waterworks, of sewerage, or of drainage on the isthmus. The people depended for their water largely on unprotected cisterns filled during the rainy season, and on barrels supplied from near-by streams, all breeding places for mosquitoes. The filth of

1. Steam drills at work preparing for blasting.
2. Steam shovel loading a Lidgerwood train, 1906.



1. Battery of well drills at work in foreground and another in the background, preparing for a gigantic blast.
2. Battery of tripod drills at work.

ages had accumulated around the dwellings and in the streets, undisturbed except when washed away by torrential storms. Pools of stagnant water had existed for years in proximity to dwellings, and insect-breeding swamps lay undrained adjacent to the cities and many of the towns.

Under the direction of Colonel Gorgas 3,500 men were put at work on sanitation. Panama, Colon and the towns, villages, and labor camps in the Canal Zone were fumigated over and over again, at first house by house to stop the spread of the disease, and afterward as units, one city, village, or camp at a time. Yellow fever was extirpated in less than four months, and there has been no return of the disease. In June, 1905, there were 62 cases of yellow fever on the isthmus; in July, 42; in August, 27; in September, 6; and in October, the worst month of the year for the disease, 3, not one of these last among the employees, and all originating many miles from the line of the canal. To understand what was accomplished by our sanitary work it is only necessary to compare the death-rate on the isthmus during the French occupancy with that after Colonel Gorgas began to "clean up." In August, 1882, the second year of the French occupancy, with a force of 1,900 men, the death-rate was 112 per thousand. In August, 1905, with a force of 12,000 men, there were only 8 deaths, or two-thirds of a man per thousand. The average daily sick-rate among the employees of the commission during the ten months from January 1, 1906, to October 31, 1906, was 28 per thousand, which was no higher than might have been expected in an equal number of laborers engaged in construction work in any part of the world. So far as general health conditions were concerned, no stronger evidence for their favorable character may be adduced than the fact that among about 6,000 white Americans, including women and children, on the isthmus during the rainy season of 1906—August, September and October—there was not a single death from disease.

Within our first four months on the isthmus we established a hospital system that included a large hospital at Colon, another at Ancon, and a number of smaller hospitals along the line of the canal. The one at Colon was built on piers over the Atlantic Ocean, and patients there had at all times the benefit of cool and invigorating sea air. The hospital at Ancon was, and is, one of the largest and best equipped in the world, situated on the hill above Panama and commanding a superb view of mountains and sea. Colonel Gorgas organized a staff of physicians and nurses inferior to none in civilization. President Roosevelt, in a special message to Congress written after his personal inspection of the isthmus, said of the sanitary work there that "the results have been astounding," and that "the conditions as regards sickness and the death-rate compare favorably with reasonably healthy localities in the United States."

During the railroad men's régime on the isthmus we converted the City of Panama, which on our arrival was without pavement, sewers, or water supply, into the best-paved, the best-watered, and the best-sewered city in Central America or the northern half of South America. We constructed for it a great reservoir with an abundant supply of pure water, and installed for it a fire service that on two occasions has saved the city from destruction. We also constructed for Colon a great reservoir, with a capacity of 508,000,000 gallons. We paved the main street of Colon with vitrified brick, and raised the surface of other streets and covered them with crushed rock. Before we left the Canal Zone it was as safe a place to visit as most other parts of the world, and much safer than many parts of the United States, so far as danger from disease was concerned. Observance of sanitary laws and regulations was compulsory and rigidly enforced. Whenever an employee of the commission was discovered with too high a temperature, he was compelled to go to the hospital, whether he wanted to or not. To

Colonel Gorgas is due all the praise for the triumph of science over disease on the Isthmus of Panama, but he would not have accomplished the magnificent results achieved there without the active and sympathetic coöperation of the commission. The United States paid out something like $4,000,000 in less than a year in the sanitation of the canal route, and Colonel Gorgas has said that he would not have dared authorize the expenditure of that great sum on his own initiative.

The problem of labor for the construction of the canal was almost the paramount one. The clerical forces and skilled artisans were recruited in the United States, though at first some difficulty was experienced in securing the right class of men, owing to the reputation of the Canal Zone as a disease center. To supply the unskilled labor was a far more perplexing task. During the twelve years the French had been operating on the isthmus, they had depended upon the West Indian negro for this class of work. We soon found that if the canal was to be completed within any reasonable limit of time or expense, some other source of obtaining labor must be developed, not only to obtain a better grade and a surer supply, but to eliminate the sense of security the West Indians possessed in the assurance that they controlled the situation by virtue of a labor monopoly. Agents were sent to Europe, and they succeeded in directing to the isthmus a stream of Spanish, Italian, and Greek laborers, though the negroes have all along far outnumbered the others. The erection of living-quarters for the employees and supplying them with good food and pure water was accomplished during the same period that the sanitation of the Canal Zone was carried on. Employees of every grade, white and black, were given, free of rent, with free lights and fuel, comfortable furnished houses. While many hundreds of these houses, of various classes and capacities, were taken over from the French, all of them had to be rebuilt and made sanitary, and in addition new dwelling-houses and living-quarters, hotels, restaurants, clubhouses, schoolhouses, courthouses, postoffices, jails, commissary buildings, fire-engine houses, shops and railway buildings had to be provided. Along the line of the canal we built a succession of trim villages, containing populations ranging from a few hundred up to 5,000 each. At Gatun, the site of the great dam that now holds back the waters of an inland lake 165 square miles in extent, a village sprang into existence within four months, supplied with pure water and a modern sewerage system. At Culebra, situated upon bluffs overlooking the great cut and surrounded with an amphitheater by the rising slopes of beautiful hills, a town of 5,000 inhabitants came into being with its modern sewers and water supply, on a site that a year and a half before was covered by an impenetrable jungle. Among other towns and villages we constructed along the route of the canal are Empire, Las Cascadas, and Gorgona, and in every one of these centers of population there is, in addition to the quarters and mess-halls for the employees, a clubhouse, or recreation building, each with its gymnasium, its reception, card, and billiard rooms and its assembly-hall, managed in conjunction with the Young Men's Christian Association by boards of directors selected from among the men themselves.

The food-supply proved a serious corollary of the labor proposition. If we could not feed the men, we could not build the canal. Owing to the fact that the Panama natives never look beyond their present necessities, no food ever accumulates on the isthmus, and in the summer of 1905 this disastrous condition was augmented by an almost total failure of the crops for the two preceding years, by the abandonment by agricultural laborers of the farms back in the hills for work on the canal at better pay for shorter hours, and by quarantine of the port of Panama because of bubonic plague, which prevented the delivery of foodstuffs from neighboring provinces. We

were thus brought face to face with the problem of feeding 12,000 men and their families, and our nearest available market was 2,000 miles away. We immediately arranged to open local commissary stores at every important labor camp, to provide mess-houses, and to furnish food, both cooked and uncooked, to all employees at cost. Orders were cabled to have our steamers equipped with refrigerating plants; a cold storage plant was erected at Colon, and refrigerator cars were purchased for immediate shipment to the isthmus, thus establishing a line of refrigeration from the markets of the United States to the commissary stations along the line of the canal. The net result of these efforts was that all employees were afforded opportunity to obtain an abundant supply of wholesome food at reasonable prices. We learned from experience that no price for food was sufficiently small to induce the West Indian laborers to eat enough to keep them in good physical condition. They were offered cooked food at ten cents per meal, and the uncooked material at a price reduced by the cost of cooking and service. Both plans resulted unsatisfactorily. We even tried giving them uncooked food free; they declined to go to the trouble of cooking it. Next we had it cooked and offered it to them free, when for the first time they ate heartily. The plan was then adopted that is followed in railway and other construction work in this country, and we paid the West Indians a fixed wage that included three meals per day.

Simultaneously with the sanitation of the isthmus and the erection of comfortable living-quarters for the employees and the establishment of a refrigerating system to supply them with wholesome food, we reconstructed the Panama Railroad, the most valuable instrument to the construction of the canal acquired by the United States in its purchase from the French at Panama. However, the modernizing of the road was a tremendous task. It had but a single track, practically no sidings or station buildings, a worn-out telegraph line, no terminals worthy of the name, and motive power and rolling stock that were obsolete twenty years before. Canal and commercial traffic, local and through, were nearly at a standstill; thousands of tons of through freight were piled in cars and warehouses or on the docks, and some of these shipments had lain undisturbed from three months to a year and a half, in many instances even the shipping papers and freight records having been lost. Had the docks, wharves, warehouses, terminal yards, locomotives, and cars of the Panama Railroad been in good repair, they would still have been entirely inadequate to handle and care properly for the small commercial business the road was transacting. The existing facilities, poor as they were, were rendered less effective by the entire absence of any mechanical appliances on the docks for receiving or discharging cargo from the steamships. The negro laborer was the only power employed; he was at once the hoisting-machine and traveling-crane. Imagine conditions, then, when the accumulated orders in the States for canal material began to arrive in large quantities on both sides of the isthmus. The situation was aggravated while the congestion was at its densest by an increase of fifty per cent. over the year before in the commercial business of the road, and at the moment when we believed that our predicament could not possibly be worse an outbreak of bubonic plague at La Boca resulted in two consecutive quarantines, completely closing that outlet for sixty days. Furthermore, the personnel of the Panama Railroad as it was turned over to us had not been educated on modern lines, and was completely paralyzed when confronted with the onerous conditions caused by the congestion of freight. It was necessary, therefore, to begin at once the construction of new wharves equipped with modern mechanical appliances and of large terminal yards at both ends of the road; of extensive warehouses, of suitable machine shops, and of modern

coal-hoisting plants. New and more powerful locomotives and larger cars were purchased for both passenger and freight service. The personnel of the road was reorganized, and into the more important positions we put experienced, energetic, up-to-date railroad men from the United States, where, indeed, we recruited our entire complement of yard and train masters, superintendents of transportation, train-dispatchers, and master mechanics, and an army of conductors, engineers, and switchmen. We double-tracked the road with heavier steel rails, strengthened the bridges to enable them to withstand the weight of our heavier equipment, and in 1907 the line across the Isthmus of Panama was in a position to bear favorable comparison with the average of the best railroads in North America.

Of course the most important question before the commission was as to whether the canal should be of the so-called sea-level or the lock type. The Act of Congress which authorized the President to proceed with the construction of the canal gave him almost unlimited discretion as to details of route, type, and size, the principal limiting clause being that it "shall be of sufficient capacity and depth as shall afford convenient passage for the vessels of the largest tonnage and greatest draft now in use and such as may be reasonably anticipated." The discussion on this question, which was largely one of engineering technicalities, occupied many months, and the decision we arrived at is summarized in the following extract from an address I delivered before the chamber of commerce of Atlanta, Georgia, in May, 1906:—

"The present commission believes that the type of canal the people of this country want is the one which will provide adequate and safe passage for the largest vessels now on the seas, or which can be reasonably anticipated, and which can be constructed in the quickest time and at the least cost. It has, therefore, recommended the construction of an eighty-five-foot-level lock canal, for the reasons that, first, in its judgment, 'it can be completed for about half the cost, and in about half the time, of the so-called sea-level canal; second, because it will be adequate for all the commerce which can reasonably be expected to seek that route during the next 150 years; third, because if the tonnage should increase beyond such expectation it can be enlarged more cheaply and more quickly than the so-called sea-level canal; fourth, because, from the operating point of view, large ships can be put through more safely and more quickly than the so-called sea-level; fifth, because, when the construction is added to the estimated cost of operation, the saving to the Government every year will be $2,340,000; sixth, because, when built, it will be a completed canal, completed in every appointment, for all requirements for generations to come.'"

It had been agreed between Mr. Roosevelt and myself when I accepted the chairmanship of the Isthmian Commission that I might withdraw from that position, with his sanction, so soon as the construction of the canal was under full headway. I did not, therefore, sever all my railroad connections, although for two years I devoted my entire physical and mental energies to the problems of the big ditch. My resignation was not handed in until 35,000 men—within 5,000 or 6,000 of the maximum number employed—were on the commission's pay-rolls; all the machinery essential to the completion of the canal, except that for the lock construction, had been designed, constructed, assembled on the isthmus and put into operation; the more serious difficulties attendant upon industrial operations in the torrid zone overcome, and the entire project well under way.

Colonel Goethals's splendid achievement in carrying to practical completion, without setback or delay, without a hitch of any kind or a hint of scandal, the great work of the construction of the Panama Canal, while demonstrating the thoroughness with which the railroad men pre-

pared the way on the isthmus and the care and precision with which their plans were laid, is one of which the United States Army may well be proud. Incidentally it may be remarked that so wisely considered was the order of President Roosevelt, issued to the commission of which I was chairman in November, 1905, that it has not since been necessary to amend it in any important particular. The order was as follows:

"The organization shall consist of the chairman and the following heads of departments: Chief engineer, general counsel, chief sanitary officer, general purchasing officer, general auditor, and manager of labor and quarters. The duties of each shall be as follows:

"1. The chairman shall have charge of all departments incident and necessary to the construction of the canal or any of its accessories.

"2. He shall appoint the heads of the various departments, subject to the approval of the commission.

"3. The head of each department shall report to and receive instructions from the chairman."

This order, with a subsequent minor amendment, is that of the present organization on the isthmus, except that there have been changes made in the titles of the heads of departments to conform with military usage. It was this concentration of supreme authority in one man that has enabled Colonel Goethals, as head of the military régime at Panama, to carry on and complete in such manner as to command the wonder and admiration of the world the work planned and begun under the railroad régime, as to enable me—encouraged by the loyal and able coöperation of the other members of the commission and heads of departments—to accomplish such vast results in so short a time.

# CHAPTER XXXVII

## THE TRUTH OF HISTORY

MR. STEVENS BECOMES CHIEF ENGINEER—FINDS A BAD STATE OF AFFAIRS—SANITATION OF PANAMA AND COLON ACCOMPLISHED—HERCULEAN TASK OF CREATING AN ORGANIZATION—COMMISSION GIVES ITS COÖPERATION—LABOR PROBLEM SETTLED—THE FEEDING CONTRACT—RECONSTRUCTION OF PANAMA RAILROAD—HEADS OF DIVISIONS—BUILDING NEW TOWNS—CHIEF ENGINEER RECOMMENDS LOCK-TYPE CANAL—REAL CONSTRUCTION BEGUN—THE CONTRACT PLAN CONSIDERED AND ABANDONED—MR. STEVENS OUTLINES TO PRESIDENT ROOSEVELT HIS PLAN OF COMMISSION ORGANIZATION—THE PRESIDENT SUPPORTS HIM—NO RED TAPE—ATTITUDE OF THE PRESS—ARMY ENGINEERS INHERIT A WELL-PLANNED AND WELL-BUILT MACHINE.

BY JNO. F. STEVENS

MY connection with the Panama Canal began on July, 1, 1905, my appointment as chief engineer of the Isthmian Canal Commission taking effect upon that date, to succeed Mr. John F. Wallace, who had resigned three days previously. When the position was first offered to me I did not look upon it with favor, and had made up my mind to refuse it, but after a conference solicited by him I succumbed to the persuasive tongue of William Nelson Cromwell, who, among the many others, seemed to have a deep and heartfelt interest in the success of the proposed work. And as the matter was presented to me, in view of the discouraging condition into which affairs had drifted during the period of American occupation, as a loyal American citizen, and as a cordial supporter of an administration which was represented as being much exercised over the situation, it became my duty to waive personal inclinations, and to accept the responsibilities of the position. I accordingly did so, and the arrangement verbally agreed upon between Mr. Cromwell and myself was confirmed by the chairman of the commission, on the date noted.

As soon as practicable thereafter, I sailed for the Canal Zone, landing there on July 26, taking immediate and personal charge of all affairs there (excepting government and sanitation), including the Panama Railroad, and I believe I faced about as discouraging a proposition as was ever presented to a construction engineer.

In any comments I may make upon the condition of affairs which existed there at that time, no reflection whatever is intended upon the ability of my predecessor. I had known Mr. Wallace for many years, as a high-class engineer and railway operator of great experience, and I was not long in deciding in my own mind, why and how the situation had developed as it existed. The ineffective organization of the Walker commission, the utter lack of responsibility definitely located, the endeavor to decide and act upon the most trivial matters, at a distance of two thousand miles by a body of seven men, each of equal rank, who were apparently unable to agree with each other, or with anybody else, would have been sufficient reason for a partial, or even a total failure, no matter who might have been the chief engineer.

The retirement of this commission, and the organization of the new one, on April 1, 1905, might have bettered matters, but it had not to any great extent, during the three months the latter had been in power.

There were probably several reasons for this; it would have taken a longer time than three months to have recovered from the deplorable state of affairs left by the old commission in any case, but I have always believed (and I had a fairly good opportunity to judge), that a lack of harmony or sympathy between the chief engineer and the chairman of the new commission was the greatest single contributing cause leading to a comparative failure to produce results. But there was no time to "look mournfully back into the past." The problem of changing the situation had to be grappled with, without delay, and in such manner as human judgment could best devise to meet the emergency, which was truly formidable.

Under the agreement between the United States and the Republic of Panama the former was charged with the regulation of sanitary matters in the cities of Colon and Panama. To carry out this obligation successfully required the paving, sewerage and the providing of an ample supply of water for both cities. At the time of my taking charge, plans had been adopted for the water plants of both cities and considerable work had been done on them. Much material for the paving of Panama had been ordered, and so far as the arrangements for the sanitation of these two cities had been carried, the work was creditably done. There remained, however, much yet to do, not only in Colon and Panama, but in all of the then existing towns, and others soon to spring up along the Canal Zone.

From time to time, during the past seven years, very flattering notices have appeared in various newspapers of the United States, of the condition of Colon and Panama, as regards streets, sewers and water supply. They were all true, but in justice to the engineers in civil life, who designed and built these works and wrought these changes, it should be remembered that all this was accomplished before the advent of the army engineers, and was not done by the latter, as mistakenly asserted by the articles in question.

When I reached the zone, conditions could have been worse, but they were bad enough. No real start at any effective work on the canal proper had been made, no organization worthy the name had been effected, sanitary reforms were really just beginning, little new plant had been provided, and little that was absolutely needed had been ordered. And plant and material that had been under requisition for months was so delayed in delivery as to paralyze the efforts of those who, to the best of their ability and means, were trying hard to get results.

In such organization as existed, no coöperation was apparent—exactly the opposite—and no systematic plans, as far as could be discovered, had been formulated toward carrying out the work along lines promising any degree of success.

And, worse than all, over and above in the diseased imaginations of the disjointed force of white employees, hovered the Angel of Death in the shape of yellow fever, a number of cases of which were then prevailing and from which several deaths had occurred. What many of the otherwise intelligent men seemed to expect was an order to abandon the work and go home.

To provide housing for this army, with its future great increase; to properly feed, to instill in them faith in the ultimate success of the great project, to weed out the hopeless doubters and incompetents, to create an organization fitted to undertake the tremendous work, and to fill its ranks with the proper material, was a task of heroic proportions. No one will ever know, no one can realize, the call on mind and body which was made upon a few for weary months, while all the necessary preliminary work was being planned and carried forward; and no attempt was or could be made to carry on actual construction until such preliminaries were well in hand.

While the French turned over to us square miles of engines, cars, rails, dredges, tools and plant of all descriptions, very

little of it was of practical value, and such of it as was used, was generally only until proper modern appliances could be substituted; but as time wore on, as new plant arrived and was put into service, as the force increased, as proper food and housing were provided, as improved health conditions prevailed, as the majority saw that—unconsciously perhaps to them—a real effective organization, working steadily but surely towards a definite, intelligent end had been made, the whole situation changed for the better; and that the organization was effective, the plant well designed, the working plans rightly conceived, is evident from the fact that the construction of the canal since the real beginning of work early in 1906, with but small addition to plant in hand, or under order, or material change in organization, went steadily and smoothly on to completion, with a rapidity and economy that long ago confounded and silenced carping criticism.

The work of the Sanitary Department was under the direction of Colonel (now General) Gorgas. And, as the success or failure of the entire work of building the canal rested upon the underlying basis of good health conditions, it may truthfully be said that the responsibilities of that department were of the first and prime importance. Disease and death would have conquered de Lesseps even if his finances had held out. And they would have conquered us, if, in the light of latter-day science, General Gorgas and his staff of able, devoted assistants had not so successfully handled the situation.

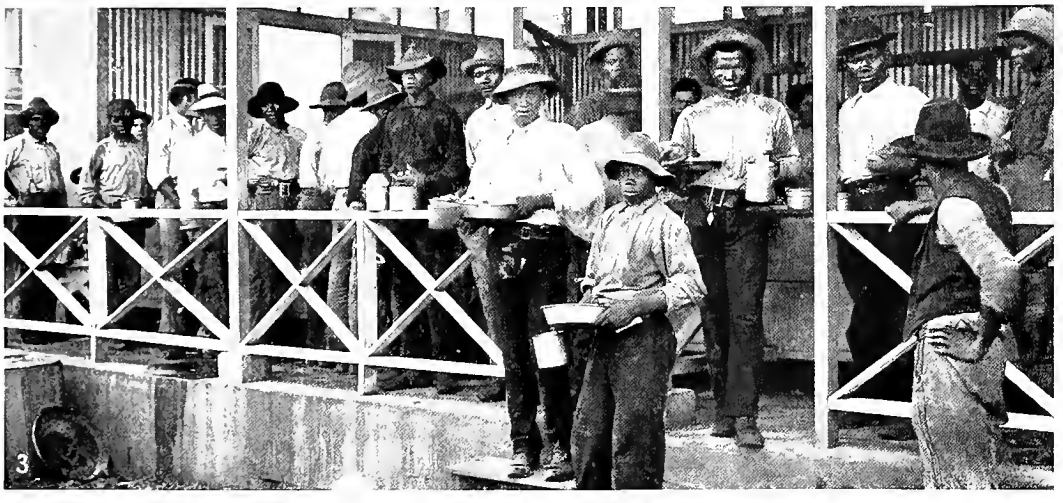
There seemed to exist, unfortunately, a general feeling, outside of the medical staff, that the work being inaugurated and carried on by this department was largely experimental, and doubts were expressed on all sides as to its permanent success.

General Gorgas was under the jurisdiction of the governor of the zone, who was a member of the commission. But I failed to find the hearty coöperation to exist which was so necessary to success. Large amounts had to be expended by the department, prompt decisions involving big questions had to be made, and I judged that the governor, being, as indeed we all were, totally unacquainted with such a problem, had a natural reluctance in assuming the great responsibilities involved. In fact, the chairman expressed the opinion that much money was being wasted by the department and seemed inclined rather to criticise than to suggest.

In line with the policy I adopted, as explained later, and knowing full well that all my efforts would end in failure, lacking proper sanitary conditions, I took the bull by the horns, regardless of regulations or red tape, and threw all the weight of the Engineering Department to the aid of General Gorgas, coöperating with him in every possible manner.

Labor was scarce at that time, but the Sanitary Department had the first call and its requisitions for laborers had preference over all others. Without waiting for orders, or even approval, the Engineering Department built roads, sewers, waterworks, hospitals, and many other essentials, at the request of General Gorgas, and I am certain that he knows and appreciates too, that the real success which crowned so royally the labors of his department began to date from the autumn of 1905; and while I know that the Engineering Department—during the period I was connected with it—has justly to its credit many things of importance, there is no single one of them all that I take more pride in as time goes by than that of the aid and help we gave to the Sanitary Department, when it was so sadly needed.

With the light of what I could plainly see had been the experience of Mr. Wallace, I determined from the start, or as soon as I could grasp the significance of affairs, that the only line of policy that promised success was one of going ahead and doing things on my own initiative, without waiting for orders or approval. One of the terms I insisted upon before I became chief engineer was that I should be un-



1. Y. M. C. A. Clubhouse Reading Room at Panama.
2. Group of Spanish Laborers.
3. West Indian Kitchen.

hampered in my work in any way, shape or manner, and I am free to say this agreement was strictly kept. The distance of the commission from the work as well as its make-up, did not admit of any other plan of procedure. As constituted, the members of the commission, who were civil engineers, were designated to act in an advisory capacity. But I knew full well that none of the board had the experience in either such construction work or transportation matters that would qualify them to dictate to me how matters should be planned and handled, and frankly I determined early that they should not.

I wish candidly to say that the commission cheerfully, as far as I know, accepted the situation, coöperated with me to the utmost, and approved formally of all my acts. I was accused by busy-bodies of being a law unto myself, of having cut the cable and all such nonsense. Not a word of truth in such talk. The commission was always kept advised by me, in due course of time, as to current events and what I had done. As a rule I never requested approval in advance for detailed expenditures in any line whatever; on the Isthmus I went ahead, made plans, saw they were executed, and later on advised the commission in fair detail what I had done, what I had expended, and asked approval, which was always quickly given.

In assuming such responsibility I felt I was taking the only sure course, although I fully realized that on me, primarily, would fall the blame, should my plans not develop into success. But I had been used all my life to accept responsibility, and a man who will not had better stay on the old farm. The only true basis of successful organization is the lodging of authority and of responsibility for results. And in this case, after I had in a way understood the plans and aims of the Sanitary Department, not a shadow of doubt remained in my mind as to ultimate success of the great project—provided the right type for the canal was adopted.

Of the many important matters that pertained wholly to the Engineering Department was the securing of the necessary labor, both skilled and unskilled, to carry out our plans, which were slowly but surely being evolved. All common labor, for years,—for the Panama Railroad, and in fact for most of the ports in different countries along the Gulf of Mexico and Caribbean Sea,—had been black, drawn from the islands of the latter. Such supply had so far proven insufficient in either amount or quality, and I at once saw that it had to be made better, if possible, by raising its standard, either within itself, or by introducing a sufficient number of a higher grade to leaven the mass.

My first thought was, naturally, Chinamen, as I had observed their good qualities for years in railway and other similar works on the Pacific Coast. But, after due consideration, through the commission, this idea was dismissed for good reasons. Then, attention having been called to the possibilities which Spain offered as a source of supply, I sent an agent to Madrid —a man well versed in Spanish law and a fluent linguist—with orders to secure several thousand men from the Biscayan provinces. This, after some difficulties, he was able to do through the assistance of the steamship companies. Their introduction as expected resulted in such a marked improvement in labor conditions that altogether nearly eight thousand of them were brought over.

At the same time, measures were taken to provide a systematic method for securing an ample supply of blacks by establishing agencies in the various English and French islands, and in a comparatively short time the problem of the necessary amount of common labor was solved.

All skilled labor was drawn from the United States, agents for such purpose having been placed in several of our large cities—those that were centers of manufacturing and railway activity. In spite of handicaps which ought never to have existed, we succeeded wonderfully well,

and after due course of time were able to keep the ranks full of all good classes—all this work being handled directly by and through our organization on the Isthmus. One of our handicaps in securing these skilled laborers was the insidious and disloyal attitude displayed by some of our home newspapers and magazines in depicting to their readers the terrible health and living conditions alleged to prevail on the Isthmus, long after the zone had become a safer and healthier place of residence than the very cities in which some of these papers were published. The words of irresponsible letter-writers were taken in direct contradiction of the facts, and screeds were eagerly scattered broadcast, poisoning the public mind, all probably for the sake of sensationalism. By me, such publications could only be given the name they would be called, if the nation was engaged in a foreign war.

The system under which food supplies were handled to the vast army of employees was an amplification of the plan under which the Panama Railroad had been supplying necessities to its men. But the enormous expansion in the demand, and the endless multiplicity of detail involved, together with the securing, housing and care of the force, made necessary the establishment of the division of labor and quarters, subordinate to the Engineering Department. This division was placed in charge of the late Jackson Smith, under whose able direction the details were all carefully worked out, and the entire problem solved in such a systematic manner that these very important matters became but coördinate parts of a well-oiled and smoothly running machine.

As, naturally, the vast majority of the white employees were bachelors, it became incumbent on those in charge of the work to provide, not only for their ordinary living quarters, but also for ample, well-cooked and served meals for all classes, at the lowest rates that could consistently be given. To this end hotels and eating houses were built, equipped and put in proper running order, at the different localities, wherever necessary. As the result of experiments as to cost of raw food and preparing and serving it, a price was fixed upon for such meals, which, after the natural discussion and criticism bound to follow, was agreed to as being fair and reasonable, and the system moved off satisfactorily.

Previous to this time, I had discussed with the commission at various times the policy of putting all the work of feeding employees into the hands of outside parties. We all realized that next to the all-important matter of sanitation came the problem of caring for the material wants of our men. But as time elapsed, and we began to see light, through the plans we were putting into effect (those for handling the matters directly, ourselves) the question of contracting for the food was held in abeyance until the success or failure of the experiments I was trying was demonstrated.

But at this particular time the commission made a contract with a party, the terms of this contract being practically such as would result in turning over to him all of our carefully installed, elaborate plant, and practically the welfare of the thousands of our employees, subject to restrictions and supervision which in my opinion would have been impracticable to enforce, and would have resulted in certain trouble and confusion. And in addition to this, the contractor was to be allowed to charge employees much larger prices than our own system had demonstrated were necessary.

Immediately I was advised of the terms of this contract I registered a vigorous protest by cable, with the effect that the chairman and contractor came to the isthmus, and after a short conference with the governor, the manager of labor and quarters, and myself, the contract was very wisely abrogated, by mutual consent. Doubtless the commission in making this contract acted only for the best interests of the work from its point of view, but

the results of such action, if carried through, would have precipitated only dissatisfaction and trouble, resulting in serious disruption and lowering of the morale of the force, and would have certainly produced large profits to the contractor at the expense of the employees.

The reconstruction of the Panama Railroad, which was under my management, was a serious problem. It was not, at the time I took charge, able to handle its commercial business, with the additional traffic already thrown onto it, and a very serious state of congestion prevailed. Owing to the delay in deciding upon the type of the canal, it was not possible to rebuild it upon a permanent location; at the same time, the extraordinary amount and variety of service it was called upon to render made quick decision and vigorous action necessary. We were very fortunate in obtaining the services of Mr. W. G. Bierd as superintendent, whose abilities I had clearly recognized while under my jurisdiction in railway work in the States. Plans were made, the work of reconstruction pushed,—hampered all the while by the necessity of handling the constantly increasing traffic—until in 1906 the railroad had been practically rebuilt, double-tracked, supplied with all necessary accessories, including those demanded by food and other supply reception and distribution, and was fully capable of, and did handle satisfactorily, every burden put upon it. We were subjected to criticism and fault-finding, some of it from high sources, that should have been a help instead of an attempted embarrassment; but I kept plugging ahead, disregarding and defying possible consequences to myself, until my judgment was finally conceded to be confirmed by results.

Meanwhile, the commission had reorganized the very inefficient Purchasing and Supply Department, placing at its head, at Washington, Mr. D. W. Ross, to whose able management, hearty and prompt coöperation, I can give only words of praise. All requisitions for supplies, material, plant, tools and thousands of different articles needed were promptly handled, and the Purchasing Department speedily became a help of the right sort, instead of the hindrance it had been in Mr. Wallace's time. In cases where, owing to price or time of delivery, possible changes in specifications looked advisable, the matter was taken up promptly in consultation and agreement arrived at without friction, and in the conducting of all business, particularly through the supply stores on the zone, the greatest harmony prevailed between the departments.

In handling the enormous amounts of money required for payment of salaries and wages on the Isthmus, not only in the actual disbursement of the funds but the methods of timekeeping, identification, etc., leading up to the actual payments, it required the skill and honesty of an unusual man—such a man as Mr. E. J. Williams, who was engaged by the commission for this work. In matters of accounts, etc., he was nominally under the direction of the auditor of the commission, but for the care and legal expenditure of all the funds he was directly responsible in the last analysis only to the Comptroller of the Treasury at Washington. Previous to Mr. Williams taking charge of the disbursement office, things had not apparently moved smoothly in matters of detail on the work, but under the system he put in force satisfaction was given: and that this important feature of the work was well administered is attested by the fact that his services were retained until the completion of the canal. Some of the unnecessarily elaborate plans for accounting, as promulgated by the auditor of the commission at Washington, caused a little friction with the disbursing office, but annoyances of this kind were not allowed to have serious consequences, and fairly harmonious action prevailed between the auditing and the other departments.

The organization of the Engineering Department was framed on simple lines, and generally the material of its personnel

with few additions was found already on the Isthmus. In addition to the staff at general headquarters, there was the Division of Building Construction—Mr. Belding in charge—under which plans were made and construction of all buildings or other structures required by the canal work were carried out, and so successfully that once material began to arrive in sufficient quantities we were able, without serious delay, to properly house and care for the thousands of constantly arriving employees. All the numberless variety of buildings required—quarters, hospitals, schoolhouses, churches, jails, fire and police stations, etc., were promptly erected and put into service. Including the amounts used by the Panama Railroad, over 80,000,000 feet of lumber was brought in from gulf ports and from the Pacific Coast, and all used in the work of this division in a year and a half.

The Division of Municipal Engineering, under Mr. Holcombe, had in its charge all improvements in the nature of sewerage, water supply, paving, street and road making, not only in Panama and Colon but in all the towns in the zone. Its work covered—like that of all the other divisions—a multitude of details, which were well planned and executed.

The Division of Meteorology and River Hydraulics was under the late Mr. Arango, a native of Panama, who was technically educated at one of the prominent engineering schools in the United States. He gave excellent service and was charged with the duties of conducting all stream measurements, of the extensive system of weather recording stations we maintained, not only on the zone, but far distant, up the Chagres River, nearly to the Darien country. Its records of temperature, rainfall, winds, fluctuating flow of streams and seismic disturbances (which were slight, and generally at long distances away) were models of clearness and intelligence, and will become more and more valuable as time goes on.

The maintenance and operation, as far as mechanical features were concerned, of all machinery, was placed under the charge of Mr. Brook, as superintendent of motive power and machinery. Locomotives, steam-shovels, rolling stock, shops, drills and field plant, were planned and built under specifications made by this division, the head of which was held responsible for results. One interesting feature of the work of this division, which I have never seen described in public print, was the planning and building of three immense air-compressing plants, located at about equal distances from each other, from which plants was fed into a pipe line, extending along the entire length of Culebra Cut (nine miles) all the compressed air that was needed to operate the hundreds of air drills employed in the cut. The able work of this division, in planning the necessary plant and tools, was a great factor in enabling the transportation system to be evolved, by which the Culebra Cut was so quickly and economically taken out.

The preparatory work and actual construction of the canal proper was placed under three division engineers. Mr. F. B. Maltby's jurisdiction extended from deep water at Colon to and including all works at Gatun dam, spillway and locks, he also having charge of the construction and maintenance and operation of all marine plant, including dredges, tugs, marine shops, etc. He also planned and erected the elaborate plant which so successfully handled the enormous amount of masonry which was used in the construction of Gatun locks by the army engineers.

The work throughout the famous Culebra Cut was supervised by the division engineer, the late Mr. D. W. Bolich, whose authority extended to and included the locks at Pedro Miguel, including the excavation and disposal of all material from the cut, no matter to what point it was taken. This involved the application of the plan of track installation which I had devised for handling this material, and which plan was followed until the work was completed. From Pedro Miguel locks to deep water in the Bay of Panama, the work was

under Mr. William Gerig as division engineer, and all matters in connection with this section were handled by him, the greater part being the dredging of the outside channel, together with the maintenance and operation of marine shops and plant on his division (as assistant to Mr. Maltby in the last-mentioned work), in which particular lines of employment he was especially qualified. In addition, he conducted all of the vast amount of surveying and test borings, which were needed to arrive at a final decision as to the details of the plan of the canal at its southern end.

These men—in details—laid the foundation upon which was built up the structure, which enabled me to demonstrate that the canal could be built; and not only our success, but the success of those who followed us to the completion of the gigantic work, is debtor to their intelligent, indefatigable labors, in putting into effect the general plans which had been given for their guidance.

I have not touched upon the organization for operation of the Panama Railroad. It was reorganized, and in some ways by drastic treatment, not only in personnel but in methods. Modern systems of accounting and store-keeping were installed, and under the experienced eye of Mr. Bierd—who was later made general manager,—the Panama Railroad became a wonderfully efficient transportation machine. And it had to be, for the amount and variety of service demanded of it cannot be paralleled in the history of the railway world.

The general charge of designing of the dams, locks and spillway was placed in charge of Mr. Joseph Ripley, whose long experience, not only in the construction, but the operation of canals, made his services of immense value. This work was well inaugurated during 1906, and a staff of designers, exceptional in ability, was selected by Mr. Ripley, who worked out all plans of these structures as they were built, with few changes, and which now stand as great monuments to their creative genius.

All this time surveys were being conducted, not only along the line of the canal proper, but elsewhere in the zone for various necessary purposes, such surveys being made in some cases to verify and supplement the records left by the French, but more to obtain exact data required by our accession of the strip of land called the Canal Zone. This work was practically continuous, and it entailed upon the engineers a life of hardship and danger—far in the dense, tropical jungles, miles from the comforts of zone life, and from the protecting ministrations of the Sanitary Department.

The general direction of all of the work of the Engineering Department was supervised and directed from the administration building at Culebra, to which I moved all headquarters—previously located in the City of Panama. At Culebra, Empire, Gorgona, Gatun, Paraiso and Pedro Miguel, we built new large towns, supplied with modern improvements, and smaller ones at many other points, of less importance. A complete system of telephones was installed, so elaborate that, sitting at my desk, I could without delay talk not only with the leading officials wherever located in the zone, but also practically with every switch shanty and steam shovel on the canal. The charge of all office work at headquarters, of correspondence, and largely of executive matters was in the hands of Mr. E. P. Shannon, my faithful and efficient secretary.

Time and space will not here permit the mention personally of the scores of other capable, intelligent, hard-working men who made up the staff of the Engineering Department. They were a fine lot of men, a surprisingly large percentage being graduates of our best colleges and high-grade schools. Almost without exception they seemed to feel that the success of the particular part of the work assigned to them meant the success of

the whole project, and with such a devoted, loyal band of assistants there could be but one result.

It may, I think, be fairly assumed from what has already been said that the position of Chief Engineer was a reasonably busy one, but the conduct and direction of the work so far outlined was only a part of the requirements. The time devoted to the discussion of the type of the proposed canal, both on the Isthmus and in Washington, seemed endless, but the part I took in it, which, without conceit, I think had some influence in the decision made, will ever be a source of gratification to me personally. I went to the Isthmus with a fairly open mind on the subject of type—if anything, rather inclined in favor of the sea level. But it did not take me long to realize that however rich and powerful in men and resources the United States might be, the idea of a sea-level canal, *such as proposed*, was absurd; that a practical one could not be built in any admissible length of time, or without the expenditure of a totally unjustifiable amount of money—enough to stagger even the financial ability of the nation.

So I became an earnest advocate of the present completed lock-type, and reported to the commission strongly in its favor, and both before the International Board of Engineers and committees of both House and Senate, and with individual members of these bodies, earnestly urged its merits; and felt then, and do yet, that the decision which was made in its favor was eminently wise, and that time will so fully demonstrate.

Visits to the States, solely on canal affairs, took up much valuable time which I felt could much better have been devoted to affairs on the Isthmus, but they seemed to be considered necessary, and were made, although several times under protest. It must be remembered that upon me fell the burden, as well as the responsibility, of not only pushing the necessary work of preparation needed to lay a solid foundation for the real work of building the canal, but also, to a great extent, the origination, coincident with the task of organization, of the plans under which the construction of the canal itself was to proceed.

I remarked previously that upon my arrival on the work, little of value had been done on the canal. Doubtless the old commission, in deference to the idiotic howl about "making the dirt fly," had instructed Mr. Wallace to try and do so with the means at hand (for I am convinced that he, of his own volition, would have done no such thing), which meant, with the exception of a few modern steam shovels, he had to resurrect a lot of old, small, and decrepit French plant, and hammer away as best he could. Engines, cars and track were all pitifully ludicrous, and no progress worth the name could be made. Standing on one point, overlooking a part of Culebra Cut, a short time after my arrival, I counted seven work trains in the ditch, and all visible shovels idle. And all available forces of laborers were trying to get these trains on to the tracks, an unwise proceeding, for they were of more value where they were.

I immediately issued orders suspending all and every effort to move material from the cut, organized all these forces into track construction gangs, and as far as material was in hand, laid work tracks of heavy rail, properly ballasted, to conform later to a definite plan I had decided upon, to enable the shovels to work to the best advantage, and the material to be moved most quickly and cheaply. The commission approved my action, and it was carried out, and no more "dirt flew" until the proper preparation had been made. To quote from a letter to a high official, in answer to a request for information on certain matters, I said in relation to my policy—"that if anyone in power realized the absolute necessity of thorough preparation along all lines before attempting to do actual work, he did not have the

courage of his convictions, and did not put such a policy into execution. I have endeavored to do so, and regardless of clamor and criticism, I propose to do so as long as I am in charge of the work. And all the criticism, from any source whatever, of my course in adopting such a policy, will have no effect upon me; and I am confident that if this policy is adhered to, the future will show its absolute wisdom."

The bulk of the common labor being of such a low rate of efficiency, prompt consideration of ways and means to increase the value of these blacks was necessary. From the viewpoint of the white man, the lack of a sufficiently nourishing diet seemed to be largely responsible for their small value. So the experiment was tried of furnishing them, at fair prices, such raw food as suited their needs, and to which their race had for generations been accustomed. In some individual cases an improvement was apparent, but the fact remained that the great bulk of them were, to put it plainly, too indolent to cook the food, preferring to eat raw, such of it as they could. Then we established eating stations, or messes, for all of them, at which places every one, excepting those who were married and living at their homes, were obliged to take their cooked food, the cost of which was deducted from their wages.

The good effect of this move was at once noticeable, and their efficiency increased to a marked degree, and this improvement was enhanced by the introduction of the Spanish, by showing the blacks that they did not control the labor market—as some sort of such hazy idea had gotten into their heads. These negroes are a childlike, amiable sort of people, moral, according to their standards, and easy to control. Those from the British Islands all had a smattering of education, and exhibited it on every occasion. One old man whom I had as a personal servant well illustrated this tendency, when he said: "Mr. Stevens is a fine man, we all love him, but he does not use good English,"—a fact which the patient reader has probably long since discovered.

No serious labor troubles ever occurred during the period in question. One class of our skilled labor, which was enjoying a wage scale that, in addition to the many privileges wisely granted by the commission, really resulted in an advance of more than sixty per cent. above the wages paid for similar work in the States, demanded a very large increase, coupled with the usual threat of a strike, and as a matter of fact some of them did stop working for a few days. This was rather a relief to me, as we were overstocked at that time with this class of men, waiting for necessary preparatory work to be completed.

I refused to make the concessions asked, and plainly told them that our ships were running light, north-bound, and would be glad to fill up their passenger lists. As the Secretary of War, who next to the President had supreme authority over canal affairs, was on the Isthmus, I took up the matter with him, and after due deliberation he sustained my position. The men went back to work, and the incident was closed and remained so during my term of office.

There was a sporadic attempt to make trouble among a fire-eating few of our Spanish laborers, but prompt and drastic action by our zone police put an end to the affair in an hour. Of course, there were the usual malcontents, always present and always vociferous among so many men, but their influence was nil, as far as results were concerned. The whole force —of all classes and races—once living and health conditions became normally what they should be, settled down in a business-like way, and affairs moved off smoothly.

Practically an open door was kept at headquarters for all classes and grades of employees. Complaints and suggestions were listened to patiently at all times, and adjustments were made as equably as possible and did exact justice to all. At

least one-half of my time during daylight hours was spent—generally on foot—along the work and among the labor camps, and my knowledge of the situation was gained very largely by personal contact, and not from routine reports.

During all the time the work of preparation was under way, and coincident with the consideration of the plans under which all phases of the construction was to be carried on, the question of the proper amount and character of the plant which would be required was a pressing and vital matter. The delay in the decision as to the type of the canal was a serious handicap in deciding all of these problems, but once the type was decided upon, then quick action was taken. Vast quantities of all sorts of machinery for all classes of the work, from locomotives to monkey wrenches, track material, steam shovels, cars, and a variety too great to even give a faint suggestion of here, were requisitioned, and for such plants as required special designs, plans and specifications were prepared and orders were placed as soon as the necessary data were available; so that in 1906, enough plant and material had been assembled to enable us to make a real start, not only in Culebra Cut, but also at many other points along the line—notably at Gatun dam and locks and at Pedro Miguel. And the work thus inaugurated during that year went on without cessation, until the completion of all work in 1914.

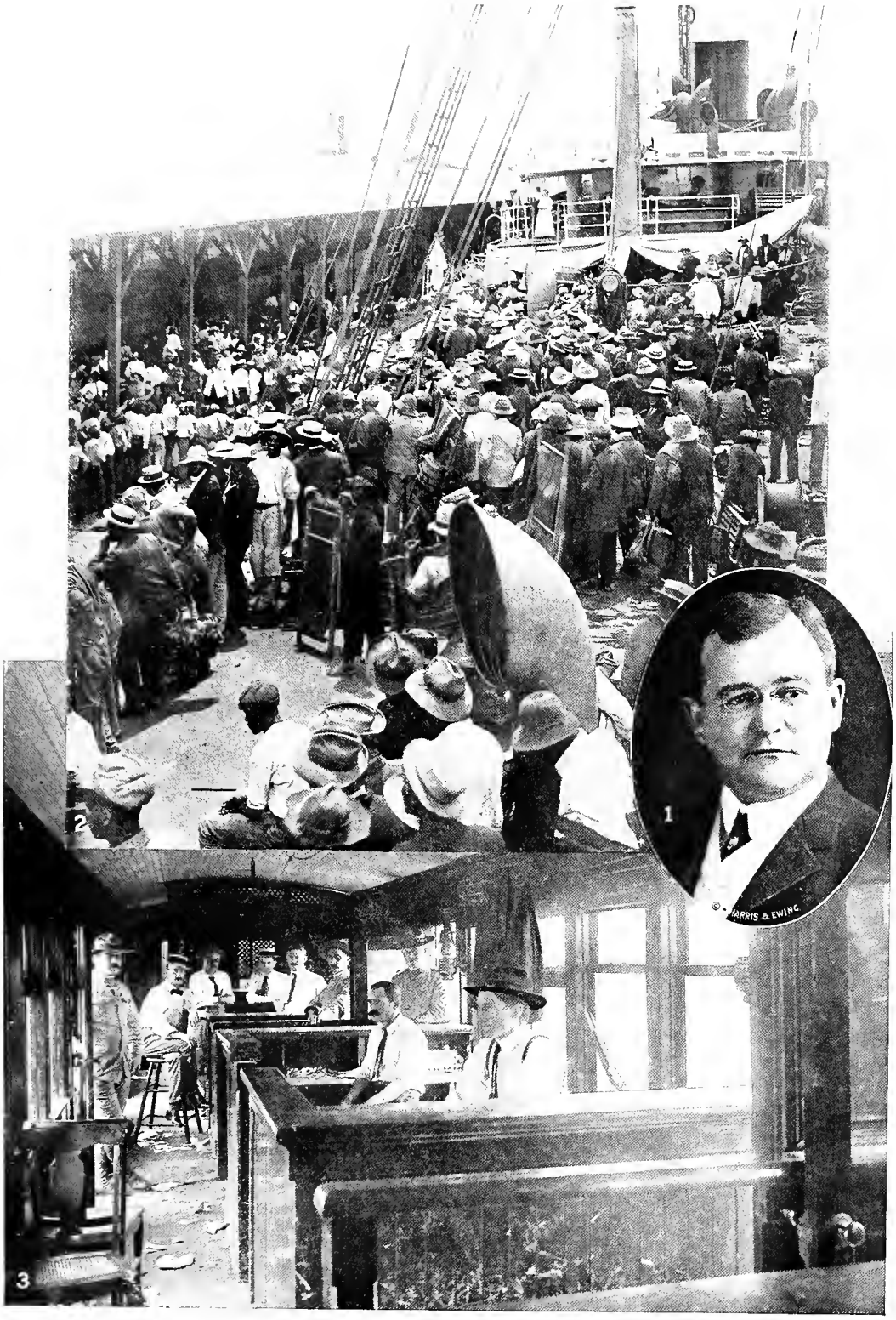
The relations of the Engineering Department to the various departments under the charge of the governor of the zone were pleasing and harmonious. Especially was this true as regards the policing of the zone, with which we had much to do. Its affairs were administered wisely and firmly and the conduct of all governmental functions contributed much to our progress.

We were thrown often into contact with the officials of the Panama Republic, and speaking for my department, I can truthfully say that we found them a high-grade lot of men, with whom, by the ordinary amenities of life, the most cordial relations could be maintained, and among the many pleasant recollections of a busy life are those of the friendships formed among these people.

It may be thought that in my references to the members of the engineering staff I have pictured them as a very exceptional lot of men. They were not; they were simply a group, truly representative of the best type of educated Americans, who needed only to be shown the way, and to be provided with the proper means to accomplish results; and they did so with an eye single only to the interests of the great project.

I have spoken of the apparent lack of coöperation which existed between the various officials in 1905. To eliminate this discordant note I early instituted weekly meetings, at which were present a representative of every department of the canal, of the Panama Railroad, and the division engineers. At these meetings a general discussion of all work in progress was taken up, and whenever such work was found to interfere with, or to be not in line with the best interests of all departments, adjustments and changes were made, so that these interests were mutually provided for. The same adjustment was made of all work planned to come up in the immediate future, each member of the council being called upon to explain his plans and scope of work, and then and there, any criticisms or suggested changes necessary to conserve the welfare of the work, as a whole, were presented, considered and finally settled. In a word, each official was enabled not only to get a clear idea of the work of his associates and its relation to his own, but also to realize that the interests of his department, however important in his eyes, were but the component parts of a great system, to the successful establishment of which all were mutually interested. The good results coming through these meetings were soon apparent, and thenceforward perfect teamwork became the

1. Lunch time in Culebra Cut; laborers waiting for the work trains.
2. Dining room in one of the "line" hotels.




1. E. J. Williams, Jr., paymaster of the canal, who handled over $250,000,000 in cash.
2. Types of canal workers.
3. Interior of pay car, which carried 1600 pounds of gold and 24 tons of silver coin on each monthly trip.

rule, and it was remarkable how much assistance each could give to the other and to the advancement of his own work.

Owing to the difficulties encountered in securing men of experience for subordinate positions in the early stages of the work, I inclined strongly to the belief that to secure the quickest and most economical results it would be best to place the purely physical parts of it under contract, and on my expressing such views I was requested by the chairman to outline formally such a plan as I might deem practicable, and accordingly I did so.

A careful study of the conditions under which any contract could be entered into and carried out made me absolutely sure that, owing to the multiplicity and variety of details which were known and which must be considered, there would enter into the problem many unknown factors, some of which it would not be practicable to provide for, or even foresee, under any system based upon unit prices. I, therefore, reverted to the well-tried-out plan of contract by percentage, which plan on the whole, when well conceived and honestly executed, is as fair to all interests as can be devised.

My underlying idea was that it might be possible to attract the attention and cooperation of strong railroad and general contractors in the United States, who by combining their strength and influence could form a powerful syndicate, one that not only would command the respect of the business world, but would easily be able, by utilizing their own well-trained forces of experts in all lines of construction, to at once make up an organization composed of the best material that the world afforded. All of these contractors have a following of such men, who are reluctant to leave their service, as I found when trying to build up an independent organization.

After serious study I drew up a plan based upon percentage, under which I considered the interests of both the government and the contractor would be carefully guarded, and every contingency possible to foresee would be provided for. By this plan all governmental and sanitary laws and regulations were to be undisturbed, and the commission, through its chief engineer, was to be to all intents and purposes as much the dictator and arbiter as though the work was to be carried out by its own forces.

The plan was cordially approved without modification by the commission and consideration of it by the higher powers that were was given without delay. But on a trip which I made soon thereafter to Washington, I found that such changes and modifications—mostly of a purely technical character—had been made, that in my opinion would render it unattractive to the class of contractors I desired to interest. However, bids were asked and a few were obtained, none of which were satisfactory in the judgment of all—including myself.

Inasmuch as the objects sought to be accomplished had not been attained, all of the bids were rejected, and decision was made to go on and complete the work with our own forces, which was probably wise. The organization had been so improved and perfected, and such a satisfactory rate of progress was being attained, that it was not thought advisable to incur the certain delay and possible disappointment which another call for bids might entail, as we knew we were certain of success in the handling of the work, as it was then proceeding.

Any present discussion which is being indulged in as to the great superiority of the plan under which the work was done, as compared with what might have been the result if it had been done under contract, is entirely futile. The record is made, as far as the one method is concerned, and only hypothesis and theory can be set forth in regard to the other method, and when such speculations are made by parties having had no practical experience in handling large works by percentage contract, their opinion can

have little weight. I know—from actual experience gained through the expenditure of many millions—that great efficiency and economy will result from such methods properly handled.

In view of the many complimentary remarks passed upon the organization that was finally adopted governing the whole work, I quote below a letter which speaks for itself:

Culebra, August 5, 1906.

Sir:—

In compliance with your instructions, that I outline my ideas as to a proper organization, that will permit the construction of the canal to be carried out in the simplest, quickest, and therefore, best manner, I have the honor to report I have given much thought to the matter and to say,—

I believe that the power and responsibility should be concentrated, not divided; that the commission, constituted in whatever way it may be, must practically be a unit, and as such, must resolve itself into what will amount to a one-man proposition.

That from now on, everything should be made subordinate to construction, and that,—complying, of course, with the law governing,—the members of the commission should be such men as will be in direct charge of, and responsible for, the most important phases of the work, and as far as consistent, they should live on the Isthmus.

That so long as a large commission must be maintained, the division of duties to each other, should be clearly defined, and the chairman should be the responsible head.

That purely Governmental functions should be entirely separated, in theory and practice, from the work of canal building, excepting so far that all officers representing the United States, shall understand that the sole and only object they have in holding office and living on the Isthmus, is to enable the United States to build and operate the canal.

I have, in consultation with Chairman Shonts, thoroughly threshed over these matters, and wish to say I am entirely in accord with him, and that I believe an organization along the lines we have drawn up, a draft or outline of which he takes to the States with him tomorrow, is the best and strongest that can be devised.

While the canal may be paid for by the eighty odd millions of the people of the United States, the construction of it can be successfully carried on only under the supervision of a very limited number of them.

Respectfully yours,

JNO. F. STEVENS,
Chief Engineer.

THE PRESIDENT,
Oyster Bay,
N. Y.

It will be seen, I think, that there is a striking similarity in the suggestions outlined in this letter, and the plan that was put into effect at a later date. And the remark in the letter, that I collaborated with any one in drafting it, was a polite fiction, excusable perhaps, for reasons of policy, which seemed desirable to maintain.

I have heretofore referred to the fact that I always had the approval and cordial support of the commission in whatever I undertook and carried out, and without such help, of course the results achieved could not have been attained. In so far as this, the commission is entitled to great credit, but I want distinctly to state that, as far as the Engineering Department was concerned, all its plans, including the securing of labor of all classes, the housing, supplying and feeding of the same, the designing and the ordering of all plant, the conception of how the work, both preparatory and permanent, should be carried out, were made and executed on the Isthmus, by that department, within itself, and not by the commission. And I fail to recall even a suggestion in reference to any important matter, much less an order, which was ever given out by that body, in regard to, or governing in any way, the methods we pursued in planning or carrying out the work, with the exception of the one concerning the unfortunate food contract, to which I have alluded.

Possibly, such a policy would not have succeeded if the personnel had been different. I knew I had a staff that could be depended upon, not only to loyally and efficiently carry out any plan given to it, but also to suggest and originate plans, when its members found that they were expected to do so, as a part of their duties. And I have always been ready, and I am yet, to assume the entire responsibility for what we did, and to smile at the "damning by faint praise," and the efforts of interested parties to ignore the truth, and to seize all the glory that is so liberally exhibited to the public.

During my time as chief engineer, I had much direct association with both the President and Secretary of War, and never for a moment did either fail to give me

the most whole-hearted support and encouragement. They both realized the serious nature of the problem, and the aid they extended was of the greatest service to me.

President Roosevelt's ideas always furnished food for thought, and the suggestion that we place our clubhouses under the management of the Y. M. C. A. was one of his happiest. It came to me from him, and so I give to him the credit.

Our relations were always harmonious, and are yet, and all statements to the contrary, which have been published by irresponsible writers, are entirely erroneous. I am betraying no confidence when I say I knew that under the plan of organization I have referred to, every interest would have been placed in my hands, should I have so desired. And when, for purely personal reasons, I tendered my resignation as chief engineer, I did it unreservedly, and not with any string, or attempted bluff, as was reported. The President was not a man to be bluffed, even if my respect for his high office, as well as my regard for him personally, would have permitted any such preposterous action. My reasons for resigning were purely personal, and for nothing whatever in regard to the canal, its organization, or any one in any way connected with it.

And, as to having been hampered by so-called red tape or Washington ways of doing business, I think I have made it clear that nothing of the kind ever occurred in my experience. I have explained the relations I held with the commission; and with the President and Secretary of War, it was always a case of "cut the corners," to an extent which made it a positive pleasure to do business with them.

The attitude of the great majority of our newspapers was very friendly toward us, when represented by their regular correspondents, who were a high-grade class of men, and whose reports were always made up as the result of their own observations. To me personally they were more than kind, and I feel that much of our success was due to their intelligent work. They were free in criticism when occasion justified, and as equally free in commendation of methods and results which proved worthy.

Of the work of Colonel Goethals and his corps of efficient assistants, of course nothing but words of praise can be given. It has always been a source of gratification to me that the management of canal affairs fell into the hands of an able man, one who had the breadth of mind which enabled him to give credit to those who preceded him, which he has done on many occasions. The manner in which the completion of the gigantic work was carried out was a great triumph for American men and methods.

We handed over to the army engineers a well-planned and built machine, one that was running fairly smoothly, with perhaps a squeak or a hot bearing here and there, as is always inevitable with new machinery. Improvements in detail could be and were made, as would have been the case no matter who had been the engineer. But the fact remains that no radical change was made in any of its component parts, and that it proved such a success was no surprise whatever to me. It was probably wise to place the work in 1907 in the hands of the army engineers, in order to secure certain continuity of supervision, which as events had proved could not be relied upon without so doing. But it is well known to many that it would have been entirely possible to have quickly secured men in civil life, who could have carried the work on as rapidly and as economically as did the army men.

This statement does not imply any disparagement of the work of Colonel Goethals, or of his staff. A good executive, with an ample experience in construction, possessed of a clear head and a strong arm, could have turned the crank and ground out as finished and complete a result as has been achieved. If I had not been fully aware of this, when I resigned, I should have remained in charge.

During the last year of my service, and at times since, I have received many letters and verbal comments—all unsolicited, of course,—from men of every walk in life, all very complimentary in character as to our work. And with the certain penalty of being accused of a lack of modesty, I quote one letter here, as showing that occasionally a ray of light from the outside illumined the dark places. I do this, because I know the kind words were intended to apply, not so much to me personally, as to the Engineering Department, of which I happened to be the head. And while it is a voice from the Great Beyond, it will appeal to many who knew the writer to be sincere in whatever he said:

Hotel Tivoli, Ancon, Canal Zone,
March 16, 1906.

Mr. John F. Stevens.

Dear Sir: Fearing I may not see you before we sail, I want to write a word of appreciation of your splendid work here on the Isthmus. I had not the faintest conception of it before I came here. I can imagine something of the chaos that existed when you came here; but the order which you have brought out of the confusion is marvelous. Your organization is most complete. You have proven yourself not only an engineer of the highest rank, but an able and thorough executive. The world will some day realize the debt of gratitude it owes to John F. Stevens.

With best wishes for your future, I am,

Yours very truly,

SERENO E. PAYNE.

In looking back over the events which took place during my time of service with the Panama Canal, and of which I had a hand in shaping, I can see some which could have been better met, and many that satisfy me in their outcome. And I know full well that when all motives, actions and results are subjected to the melting pot of time, when "the tumult and the shouting dies, the Captains and the Kings depart," each and every one who had his share, small or great, in the wonderful enterprise, will be given the true place in history to which his work entitles him.