

CHAPTER V

THE TRANSFER OF THE CANAL

THE assets in hands of the receiver of the Panama Canal Company, which included the work done on the Isthmus, were conservatively valued by him at \$90,000,000, but, of course, they were worth little or nothing unless the operation should be continued. To abandon it would be to entail upon upwards of two hundred thousand persons, most of them poor, or in moderate circumstances, losses which they could ill afford to bear. The receiver addressed himself with vigor to the task of renewing confidence in the enterprise as the first step towards securing the necessary funds for its continuance. He appointed an able committee to investigate the situation on the Isthmus and determine the future possibilities. In the last month of 1890, this committee repaired to Panama and after a careful examination of the work and the conditions to be met, reported that a lock canal could be completed in eight years

at a cost of \$100,000,000 of additional money. It recommended that a company should be organized for the purpose.

In pursuance of this object, Lieutenant Wyse was sent to Bogotá by the receiver. Wyse secured an extension of the original concession for ten years on the condition that the prospective company should be fully organized by February, 1893, and that the waterway should be open to traffic before the close of 1904.

In October, 1893, the New Panama Canal Company was organized, an extension of time having been granted by the Colombian Government for a consideration. The Company had a capital of \$13,000,000 to begin with, and the ownership of all the material assets of the old company. When the Canal should be completed sixty per cent of the profits were to be paid to the latter for the liquidation of its liabilities. The Government had by extraordinary action in the matter of legislation enabled the New Panama Canal Company to get started, but its assistance stopped there and it assumed no responsibility for the Company's future.

The directors took a wise step at the outset. A technical committee was appointed to direct the operations and determine upon the precise

plan for the Canal. The *Comité Technique* was composed of seven French engineers and seven foreigners, including two Americans. The body represented an aggregation of extraordinary talent and several of the members had extensive knowledge of canal work. The committee performed its task in the most thorough and painstaking manner. It began by examining all the technical data derived from the old company, endorsing it, or rectifying it, as the case might be. It made new surveys and, while securing information upon which to base a plan for the projected waterway, directed the continuance of excavations where they would be sure to serve in any course of operation that might ultimately be adopted. The work of this committee was by far the most valuable that had been accomplished upon the Isthmus up to that time. When the American authorities took over the assets of the New Panama Company, the Chairman of the Isthmian Canal Commission declared that the maps and documents which originated with the *Comité Technique* were worth one million dollars, or more.

In its final report, which was submitted at the end of 1898, the committee estimated the cost of a canal which should be equal to the utmost



THE SLIDE AT CULEBRA, OCT. 16, 1909.



demands of commerce and could be finished in ten years, at \$100,000,000. It recognized three principal difficulties to be contended with. These were the problem of sanitation, the cut through the Culebra pass, and the control of the Chagres River.

“The studies of the New Company were based on three fundamental principles: (1) To reject any plan that did not, independently of considerations of time and expense, offer every guarantee of a serviceable canal. (2) To reject any fanciful scheme depending on the application of new and untried devices not justified by experience; and (3) to give due weight to the peculiar tropical conditions under which the work must be executed. These must compel the employment of a class of laborers inferior to those available in better climates, and the work will be exhausting to those supervising the constructions. No technical details should therefore be admitted involving operations of exceptional difficulty.”¹

While the plans of the French Company and the opinions of its engineering experts were of general interest so long as the form of water-

¹ Problems of the Panama Canal. Brig-Gen. Henry L. Abbott U. S. Army (retired). Late member of the Comité Technique New York, 1905.

way to be adopted by us remained in doubt, a recital of them now would be wearisome to any but the technical reader, who may easily apply to first hand sources. Suffice it to say that they were well conceived, and might possibly have been carried out but for several adverse circumstances which were beyond the control of the Company, and chief of which was the promotion of the American project for a canal across Nicaragua.

The fact of the French launching the Panama Canal enterprise did not deter those who desired to see a waterway constructed by Americans from pursuing their object. In fact, two of the delegates from the United States to the Paris Conference of 1879 were prominent members of a corporation which was shortly afterwards organized for the purpose of making a canal in Nicaragua. But, with the progress of time, sentiment grew in favor of the Government assuming the undertaking, and the failure of the French tended strongly to increase it.

In 1884, the American Secretary of State and the Nicaraguan Minister at Washington came to an agreement which provided for the construction of a canal, to be held and controlled by the two countries jointly. One of the condi-

tions of the proposed treaty was that the United States should guarantee the territorial integrity of Nicaragua and this feature militated against its ratification. The idea was not allowed to die, however. In 1887, an expedition was sent to Nicaragua to survey a canal route. In 1889, Congress granted a charter to a corporation known as the Maritime Canal Company of the United States, which had for its purpose the construction of a canal in Nicaragua. The company was capitalized at \$150,000,000 and a construction company with \$12,000,000 capital stock was shortly afterwards formed. Work was begun on the Atlantic end and continued for three years, at the end of which time the construction company had exhausted its resources. Unfortunately, its appeal for additional funds was made during the panic of 1893, and met with a result which in better times might have been otherwise, for there was the keenest desire in America to see such an enterprise successfully carried out. The Construction Company was compelled to go into the hands of a receiver and work on the Nicaragua Canal ceased.

During the following decade numerous attempts were made to promote private enterprise in this direction and to induce Govern-

mental action in it. At length, in 1897, Congress created an Isthmian Canal Commission and appropriated \$300,000 for its use. This body was headed by Admiral John C. Walker and included a number of prominent engineers, both civil and military. The Commission went to Nicaragua and made a close investigation of conditions, which resulted in a unanimous report favoring a canal at Nicaragua. Meanwhile, the improbability of the French completing the work at Panama had become so apparent that attention was turned in that direction as possibly affording a desirable alternative. In June, 1899, a new commission was appointed with Admiral Walker as Chairman, and it was charged with the duty of making a comparative estimate of the two routes.

The Commission inspected the operation at Panama and extended its investigation to Paris. The consent of the Colombian Government to the transfer of the concession having been gained, the New Panama Company was invited to state the terms on which it would convey to the United States Government all its rights and assets. The proposition placed the Company in rather a delicate position. The Commission had no authority to accept an offer and in real-

ity was only seeking for information. Under the circumstances, the Company was justified in declining to commit itself definitely. It set the price tentatively at somewhat less than \$110,000,000, but offered to submit the property to expert valuation and arbitration whenever the value put upon an item should fail to meet with the approval of the representatives of the United States. This proposition was fair enough. The figures were based on the conservative valuation by the receiver of the assets that came into his hands and on the work and material added by the New Panama Company. Of course the members of the Commission fully realized this, but they seem to have considered it their duty to take advantage of the helpless position of the Company to drive a hard bargain. Had they been dealing with the French Government the matter might have assumed a somewhat different aspect, but when it is considered that the sellers were an aggregation of needy persons who, at the best, would suffer heavy loss, the United States does not appear in a very admirable light in this transaction.

The Isthmian Canal Commission rendered its report to the President in November, 1901. It omitted the memoranda of assets and detailed

valuation submitted by the Company, and merely stated that "the total amount for which the Company offers to sell and transfer its canal property to the United States" is \$109,141,500. The Commission's estimate of the value was \$40,000,000!

The report terminated with the following recommendation: "After considering all the facts developed by the investigations made by the Commission and the actual situation as it stands now, and having in view the terms offered by the New Panama Canal Company, this Commission is of the opinion that 'the most practicable and feasible route' for an Isthmian canal, to be 'under the control, management, and ownership of the United States,' is that known as the Nicaragua route."

When the decision became known in Paris consternation seized the directors of the Company. They inferred, however, that it was not conclusive and realized from the phrase, "and having in view the terms offered by the New Panama Canal Company," that the chief obstacle was the question of price, but they would not assume the responsibility of selling the property for such an inadequate sum as that suggested by the Commission and resigned.

A general meeting of the stockholders was immediately held at which it was determined to submit to the estimate of the Commission. There was practically nothing else to do. If the United States should proceed with its unlimited resources to construct a waterway at Nicaragua the Company could never hope to complete its undertaking, or to make it profitable if completed. The decision of the stockholders was promptly telegraphed to the Commission and led to a supplementary report stating that "the unreasonable sum asked for the property and rights of the New Panama Company when the Commission reached its former conclusion overbalanced that route, and now that the estimates of the two routes have been nearly equalized the Commission can form its judgment by weighing the advantages of each and determining which is the more practicable and feasible. . . . After considering the changed conditions that now exist, the Commission is of the opinion that 'the most practicable and feasible route' for an Isthmian canal to be 'under the control, management, and ownership of the United States' is that known as the Panama route."

Congress passed the Spooner Bill, authoriz-

ing the President to acquire the property and rights of the New Panama Canal Company for a sum not to exceed \$40,000,000 and to negotiate with the Colombian Government for the perpetual control of the territory needful for operating the Canal; it also directed the President to place the work in the hands of a commission to consist of seven members of his own appointment.

In 1903, Secretary Hay and Doctor Herran negotiated a treaty designed to secure to the United States the right of constructing a canal through the Isthmus of Panama and of exercising perpetual jurisdiction over the strip of territory traversed by it. In return for these benefits a payment of \$10,000,000 was to be made to Colombia. The politicians of that country, in their dealings with the Panama Railroad and the French canal companies, had become so accustomed to the milking process as applied to concessionaries that they looked upon the American overtures as a providential opportunity for playing the game anew. The national legislature declined to ratify the treaty, no doubt with the expectation that a better offer would be made. Indeed, the Colombians had every reason to believe that they

could extort almost any terms that they might choose to impose, for the French concession had only until October, 1904, to run.

The action of the politicians at Bogotá was far from pleasing to the people of Panama, who fully appreciated the great advantages which would accrue to them from the construction of a canal by the United States. They had long been dissatisfied with the central government and had more than once revolted against it. At this juncture their leading men determined to take matters into their own hands. They sent secret emissaries to the United States who reported that in the event of the Province of Panama throwing off the yoke of Colombia, there was no doubt about the United States recognizing its independence. The activities of these agents, the principal of whom was Dr. Amador, who became the first president of the new republic, soon came to the knowledge of the authorities at Bogotá and led them to take steps before the revolutionists had carried their preparations any farther than the stage of planning.

A detachment of the half-clad and poorly armed youths who composed the Colombian army were despatched to Colon for the purpose of seizing the conspirators and conveying them

to the capital. On their arrival the management of the Panama Railroad declared its inability to transport them, until a sufficient amount of rolling stock should be sent in from the other side. The principal officers determined to go forward at once. On their arrival at Panama they were seized and held by the revolutionists.

The Colombian troops at Colon made a demonstration against the American residents, and threatened to destroy the railroad property. Trouble was averted by the landing of marines from the U. S. S. *Nashville*, which was in the harbor at the time, and two days later the detachment of Colombia's army took ship for Bogotá. The revolution had been accomplished without the spilling of a drop of blood.

There is no doubt that the Panama Railroad management played into the hands of the revolutionists in their natural desire to see the American project put into effect. It is equally unquestionable that the action of the marines was a powerful factor in the result, but their presence was quite unpremeditated and their interference absolutely necessary to the preservation of American life and property. The whole matter was singularly timely and conducive to the interests of the United States, but

there was no ground for the insinuations widely expressed in the journals of the time that the authorities at Washington engineered the revolution and extended covert aid to its promoters.

Immediately after the occurrence, the officer in command of the *Nashville* despatched the following account of it to the Secretary of the Navy:

“ U. S. NASHVILLE, THIRD RATE.

“ COLON, U. S. COLOMBIA, *November 5, 1903.*

“ SIR: Pending a complete report of the occurrences of the last three days in Colon, Colombia, I most respectfully invite the Department's attention to those of the date of Wednesday, November 4, which amounted to practically the making of war against the United States by the officer in command of the Colombian troops in Colon. At 1 o'clock P.M. I was summoned on shore by a preconcerted signal, and on landing met the United States consul, vice-consul, and Colonel Shaler, the general superintendent of the Panama Railroad. The consul informed me that he had received notice from the officer commanding the Colombian troops, Colonel Torres, through the prefect of Colon, to the effect that if the Colombian officers, Generals

Tobal and Amaya, who had been seized in Panama on the evening of November 3, by the independents, and held as prisoners, were not released by 2 o'clock, P. M., he, Torres, would fire upon the town of Colon and kill every United States citizen in the place, and my advice and action were requested. I advised that all the United States citizens should take refuge in the shed of the Panama Railroad Company, a stone building susceptible of being put into good state of defense, and that I would immediately land such body of men, with extra arms for arming the citizens, as the complement of the ship would permit.

“ This was agreed to, and I immediately returned on board, arriving at 1.15 P.M. The order for landing was immediately given, and at 1.30 P.M. the boats left the ship with a party of forty-two men under the command of Lieutenant-Commander H. M. Witzel, with Midshipman J. P. Jackson as second in command. Time being pressing, I gave verbal orders to Mr. Witzel to take the building referred to above, to put it into the best state of defense possible, and protect the lives of the citizens assembled there, — not firing unless fired upon. The women and children took refuge on the German

steamer *Marcomania* and the Panama Railroad steamer *City of Washington*, both ready to haul out from dock if necessary.

“ The *Nashville* got under way and patrolled along the water-front close in and ready to use either small arm or shrapnel fire. The Colombians surrounded the building of the railroad company almost immediately after we had taken possession, and for about one and a half hours their attitude was threatening, it being seemingly their purpose to provoke an attack. Happily our men were cool and steady, and, while the tension was great, no shot was fired.

“ At about 3.15 P.M. Colonel Torres came into the building for an interview and expressed himself as most friendly to the Americans, claiming that the whole affair was a misapprehension, and that he would like to send the alcalde of Colon to Panama to see General Tobal and have him direct the discontinuance of the show of force. A special train was furnished and safe conduct guaranteed. At 5.30 P. M. Colonel Torres made the proposition of withdrawing his troops to Monkey Hill if I would withdraw the *Nashville* force and leave the town in possession of the police until the return of the alcalde on the morning of the 5th.

“ After an interview with Colonel Shaler and the United States consul as to the probability of good faith in the matter, I decided to accept the proposition and brought my men on board, the disparity in numbers between my force and that of the Colombians — nearly ten to one — making me desirous of avoiding a conflict as long as the object in view — the protection of American citizens — was not imperiled.

“ I am confident that the determined attitude of our men, their coolness and evident intention of standing their ground, had a most salutary and decisive effect upon the immediate situation, and was the initial step in the ultimate abandoning of Colon by these troops and their return to Cartagena the following day. Lieutenant Witzel is entitled to much praise for his admirable work in command on the spot.

“ I feel that I can not sufficiently represent to the Department the grossness of this outrage and the insult to our dignity, even apart from the savagery of the threat. Very respectfully,

“ JOHN HUBBARD,

“ *Commander, United States Navy,
Commanding.*

“ *The Secretary of the Navy, Navy Department, Washington, D.C.*”

Following this occurrence, President Roosevelt sent a message to Congress in which he reviewed the relations of the United States and Colombia in the matter of a canal treaty and expressed his opinion of the policy that ought to be adopted toward Panama: " During all the years of negotiation and discussion that preceded the conclusion of the Hay-Herran treaty, Colombia never intimated that the requirement of the United States to control over the canal strip would render unattainable the construction of a canal by way of the Isthmus of Panama; nor even were we advised, during the months when legislation of 1902 was pending before the Congress, that the terms which it embodied would render negotiations with Colombia impracticable. It is plain that no nation could construct and guarantee the neutrality of the canal with a less degree of control than was stipulated for in the Hay-Herran treaty. A refusal to grant such control was necessarily a refusal to make any practicable treaty at all. Such refusal therefore squarely raised the question whether Colombia was entitled to bar the transit of the world's traffic across the isthmus. . . . Colombia, after having rejected the treaty in spite of our protests and warnings

when it was in her power to accept it, has since shown the utmost eagerness to accept the same treaty if only the status quo could be restored. One of the men standing highest in the official circles of Colombia on November 6 addressed the American minister at Bogotá, saying that if the Government of the United States would land troops to preserve Colombian sovereignty and the transit, the Colombian Government would 'declare martial law, and by virtue of vested constitutional authority, when public order is disturbed, approve by decree the ratification of the canal treaty as signed; or, if the Government of the United States prefers, call an extra session of the Congress — with new and friendly members — next May to approve the treaty.'

“ Having these facts in view, there is no shadow of a question that the Government of the United States proposed a treaty that was not only just but generous to Colombia, which our people regarded as erring, if at all, on the side of over-generosity, which was hailed with delight by the people of the immediate locality through which the canal was to pass, who were most interested in the new order of things, and which the Colombian authorities now recognize



A GROUP OF NATIVES.



as being so good that they are willing to promise its unconditional ratification if only we will desert those who have shown themselves our friends and restore to those who have shown themselves unfriendly the power to undo what they did. I pass by the question as to what assurance we have that they would now keep their pledge and not again refuse to ratify the treaty if they had the power; for, of course, I will not for one moment discuss the possibility of the United States committing an act of such baseness as to abandon the new Republic of Panama."

The United States entered into a treaty with the Republic of Panama, after having formally recognized its independence. This convention, which was ratified in February, 1904, is reproduced in full in the Appendix to this volume. Its chief provisions were the guarantee by the United States of the independence of the Republic of Panama; the immediate payment to the latter of the sum of \$10,000,000 and the further payments during the life of the convention of \$250,000 a year, beginning nine years after the ratification of the treaty; the grant to the United States in perpetuity of the use and control of a certain zone of land for the con-

struction and operation of the canal; the agreement that the cities of Colon and Panama shall comply with the regulations of the United States in the matters of sanitation and that it shall have the right to enforce public order in them; the guarantee of the United States that the ports of Colon and Panama shall be free for all time and that the canal shall be neutral in perpetuity.

The decision of the Government to adopt the Panama route did not deter the advocates of a canal at Nicaragua from continuing to agitate the matter. In fact, a vigorous campaign was carried on by them in Congress and through the public press for years. The slightest opportunity for adverse criticism of the Panama undertaking and the men who were carrying it out was eagerly seized upon, and so limited was the actual knowledge of the subject that newspapers whose tendency was toward impartiality were often imposed upon by writers who claimed to be expert judges. During the first three years of the American occupation of the Canal Zone there was more nonsensical rubbish printed in newspapers and magazines regarding the Canal than would appear to be conceivable in the light of our present knowledge.

There was no lack of data upon which to found a decision as to the comparative merits of the rival routes. Both had been surveyed time and again by engineers of the utmost ability. Each had important features in favor of it but the balance of advantage easily lay in favor of Panama.

Whilst the Nicaraguan coast can not boast a single natural harbor on either side, the Panama route affords an excellent one at each terminus of the Canal. In the matters of winds, rains and earthquakes, the advantage lies with the latter region. The weight of expert opinion inclines to the idea that the difficulties to be overcome in construction would be much greater at Nicaragua and consequently the cost of a canal there would be proportionally larger than that of one at Panama. The San Juan River and Lake Nicaragua present problems quite as serious as those connected with the Chagres River. At Panama a substantial amount of the work had already been done, extensive facilities, including the railroad, existed for its continuance, and the conditions to be encountered were in a less degree problematical than those at Nicaragua.

With every year that has passed since the

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United States embarked in the undertaking, the impression has gained ground that it acted wisely in taking up the task which the French abandoned, rather than entering on a similar one in a practically untried field.

CHAPTER VI

THE AMERICAN ENTERPRISE

FOLLOWING the completion of preliminaries, the President appointed an Isthmian Canal Commission to direct the canal operation. The Commission was composed of the following members: Rear-Admiral John G. Walker, U. S. N. (retired), Chairman; Major-General George W. Davis, U. S. A. (retired), Governor of the Canal Zone; William Barclay Parsons, C. E.; William H. Burr, C. E.; Benjamin M. Harrod, C. E.; Carl E. Grunsky, C. E.; Frank J. Hecker. The last named was the business man of the body. General Davis had just completed a term as Governor of Cuba. Admiral Walker had the advantage of extensive experience in Isthmian canal investigations, and recent assignments of duty had made him familiar with the details of the French operations. The remainder were engineers of exceptional ability.

The two most important posts in connection

with the work were filled by the appointment of John F. Wallace as Engineer-in-Chief, and Surgeon-Colonel William Crawford Gorgas, of the United States Army, as Chief of the Sanitary Department. The former was in the front rank of his profession and had the highest reputation as a railroad engineer. The latter was fresh from his labors in Cuba, where his fine work in the suppression of yellow fever had excited the admiration of physicians throughout the world and gained the commendation of his superiors.

The Commission was made subject to the supervision of the War Department and in his letter of instructions to Secretary William H. Taft, the President defined its duties as being the civil administration of the Canal Zone, the performance of all engineering work and the execution of all sanitary measures. The document went on to say that the inhabitants of the Zone were to be safeguarded in their persons, property and religion; that their private rights and relations were to be conserved and that their customs and avocations were to be disturbed as little as possible. The municipal laws of the Zone were to be administered practically without change and the law of the land was to

remain in force, except where it might be at variance with the principles of the Constitution of the United States.

In a later communication, the President made an important statement of the broader policy of the United States toward the new Republic:

“ The United States is about to confer on the people of the State of Panama a great benefit by the expenditure of millions of dollars in the construction of the canal; but this fact must not blind us to the importance of so exercising the authority given us under the treaty with Panama as to avoid creating any suspicion, however unfounded, of our intentions as to the future. We have not the slightest intention of establishing an independent colony in the middle of the State of Panama, or of exercising any greater governmental functions than are necessary to enable us conveniently and safely to construct, maintain, and operate the canal under the rights given us by the treaty. Least of all do we wish to interfere with the business and prosperity of the people of Panama. However far a just construction of the treaty might enable us to go, did the exigencies of the case require it, in asserting the equivalent of authority over the Canal Strip, it is our full intention

that the rights which we exercise shall be exercised with all proper care for the honor and interests of the people of Panama. The exercise of such powers as are given us by the treaty within the geographical boundaries of the Republic of Panama may easily, if a real sympathy for both the present and future welfare of the people of Panama is not shown, create distrust of the American government."

The treaty with Panama conferred extraordinary powers and privileges upon the United States. The cities of Colon and Panama, though geographically within the Canal Zone, are not included in its jurisdiction. The United States have, however, the fullest scope in the maintenance of public order and sanitation in those centres and this precludes the possibility of another revolution ever taking place. A speedy illustration of the wisdom and effectiveness of this provision of the treaty was forthcoming. We had hardly taken possession of the Zone when General Huertas assembled the ragamuffin Panaman army, numbering something less than two hundred, with the object of overthrowing the Amador administration. The mere threat of calling upon the handful of United States Marines on the Isthmus was suf-

ficient to put a quietus upon the movement. Huertas was placed on the retired list with a pension and the army was disbanded. Panama has since been in the enviable situation of a country in the revolutionary zone without a military force.

On the whole, the Panamans appreciate the great benefits that have befallen them as a direct result of the American occupation of a portion of their territory, but the merchants of the City of Panama have made serious complaint against what they consider interference with their business by the Commission in its practice of supplying its employes as far as possible with all necessities through its string of stores along the line. The Commission claims to limit its supplies to necessities, but it is difficult to draw the line. The negro, for instance, seems to think that perfume comes under that head and the inclusion of this commodity in the Commission's price lists was one of the features that lent a little color to the complaint. It had no substantial foundation, however, and was offset by the fact that the merchants of the city do not keep extensive stocks and charge prices that are often unjustifiably high. On the other hand, the Commis-

sion supplies its employes at cost, or nearly so, but if they secure clothing and groceries at a saving, they have the more to spend on luxuries, from the sale of which the business men of Panama reap the benefit. The chief argument in favor of the Commission's course is that it obviates the necessity of a trip into the city every time that a man needs to buy a pair of shoes, or a shirt. Under the French, the laborers spent their money in Panama but most of it went to the keepers of dives and saloons. The men were paid off every Saturday. For two or three days thereafter they hung about in the city drinking. Few laborers on the pay rolls of the Panama Canal Company put in more than twenty days' work in a month. It was largely to prevent a continuance of that sort of thing that the Commission decided to supply its employes with everything that they could ordinarily need. With the same motive, saloons of a limited number, under a high license and close supervision, are permitted in the Zone. That the Commission has ever countenanced, or allowed the presence, of houses of ill-fame in the territory under its jurisdiction is an unfounded libel. The low groggeries with which Panama abounded before our advent, and

which flourished under the liquor monopoly of the Colombian Government, have, for the most part, gone out of business, but there is no doubt that the legitimate retail trade of the city has increased since 1904.

The task of civil administration has not proved a difficult one. An excellent police force, which is mounted, was organized as one of the earliest measures. Criminals have been promptly arrested and crime has been greatly reduced. Good roads have been made with prison labor. The chief of these, a wide highway to extend from ocean to ocean, is nearing completion.

When the Commission arrived at the Zone, a few hundred men — and, perhaps, half a score of excavating machines, were at work in the Culebra Cut. Otherwise the operation was at a standstill. When the French transferred the property, machines and other material lay thickly about all along the line. This was necessarily left just as it lay, and in the long months that elapsed before our occupation, rain, rust, and a tropical atmosphere, wrought havoc with it. Months were required to bring something like order out of the confusion, and not until recently was any attempt made to

clear away the debris, except where it interfered with the work, so that in a progress across the Isthmus reminders of the French occupation, in the shape of abandoned and useless machines, old rails, and ruined buildings, were met with at short intervals.

A large proportion of the French material was turned to account. Many of the buildings were utilized and much of the machinery was repaired and put into use. The narrow gauge rails and small Belgian engines, which had been used by our predecessors, were, however, discarded and an improved type of excavator was installed.

The first task of the Commission was to determine upon the form of waterway. The original intention of the French was, it will be remembered, to make a canal at sea level. One with locks was determined on when the prohibitive cost of the former became apparent. During the fifteen years that had elapsed since the adoption of the first French *projet* naval architecture had made great advances and the dimensions of De Lesseps' canal would have fallen far short of satisfying the demands of commerce at the time that we took up the work, not to mention those of to-day. Congress and



LIFT SILL AND FOREBAY, LOOKING SOUTH, FROM WEST WALL, GATUN LOCKS, FEB. 1, 1910.



the American people looked for a waterway that would accommodate the largest ships that might reasonably be expected to be built for some time to come. The Commission had much greater scope than the French company in making its plans. The latter was bound to keep the cost within the limits of commercial feasibility. The former, while of course always considering economy, and aiming, if possible, to make the enterprise a paying one, has proceeded on the principle that the first and most important requirement is a commodious and permanent canal, no matter what the cost. In pursuit of this object, numerous improvements and additions have been made to the plan from time to time, with the result that the finished structure will very greatly exceed in cost the original estimates for it.

The question of whether the canal should be one with a number of locks or one at sea level caused as much discussion and partisanship as that of the route. It was not finally decided until the middle of 1908, when the construction passed into the final stage from which there could be no turning back.

The Walker Commission favored a plan for a multi-lock canal with eighty-five-foot summit

level and a lake about thirty-eight square miles in area extending from Bohio to Bas Obispo. This was practically the project recommended by the *Comité Technique* and, although it was not adopted, it formed the basis of the plan under which we are proceeding.

In rejecting the sea level alternative, the Commission made the following statement: " If a sea level canal be constructed, either the canal itself must be made of such dimensions that maximum floods, modified to some extent by a reservoir in the Upper Chagres, could pass down its channel without injury, or independent channels must be provided to carry off these floods. As the canal lies in the lowest part of the valley, the construction of such channels would be a matter of serious difficulty, and the simpler solution would be to make the canal prism large enough to take the full discharge. This would have the advantage, also, of furnishing a very large canal, in which navigation under ordinary circumstances would be exceptionally easy. It would involve a cross section from Obispo to the Atlantic, having an area of at least 15,000 square feet below the water line, which would give a bottom width of at least 400 feet. The quantity of excavation required for

such a canal has been roughly computed, and is found to be about 266,228,000 cubic yards. The cost of such a canal, including a dam at Alhajuela and a tide lock at Miraflores, near the Pacific end, is estimated at not less than \$240,000,000. Its construction would probably take at least twenty years."

Many other, and forcible arguments, have been advanced against the sea level type and the weight of expert opinion now decidedly favors the course that has been followed. At the time, however, it was an open question with the balance of public sentiment inclined toward the simpler form of structure.

Before long it became apparent that the Commission was not working smoothly. Its number and its composition were such that work could not readily be apportioned and responsibility divided among its members. The charges of inefficiency that were widely made against the body were not justified by the facts. The press and people of the United States had no idea whatever of the conditions that prevailed on the Isthmus. They expected the Commission to go down and begin excavating at a rapid rate without delay. Admiral Walker and his associates, on the other hand, knew that the wiser

course was to make thorough preparations and to get a clear idea of the task to be performed before plunging vigorously into the work. Unfortunately they yielded to the insistent demand to "make the dirt fly" and brought serious trouble upon themselves in consequence.

In January, 1905, President Roosevelt applied to Congress for more power in the organization of the personnel of the Canal operation. He declared that "the general plans for the work must be agreed upon with the aid of the best engineers of the country, who should act as an advisory or consulting body. The consulting engineers should not be put upon the Commission, which should be used only as an executive instrument for the executive and administrative work. The actual work of executing the general plans agreed upon by the Commission, after receiving the conclusions of the advising engineers, must be done by an engineer in charge; and we now have an excellent engineer.

Congress passed a bill in accordance with the President's wish, but it failed to go through the Senate. The President then asked for the resignation of the entire Isthmian Canal Commission and reformed that body, placing the direc-

tion of affairs in the hands of an Executive Committee, consisting of three of the seven members. Theodore P. Shonts, a prominent and practical railroad official, was made Chairman, with general supervisory powers. John Wallace retained the position of Chief Engineer and was made a member of the Commission with full control of the construction. The third member of the Executive Committee was Judge Magoon, who was made Governor of the Canal Zone.

It was believed that with this change a great improvement in general conditions would be seen. The need for strong and efficient control was urgent. The organization and morale of the force were far from satisfactory. The men went at the work in a half-hearted manner. These shortcomings Mr. Wallace attributed to the frequent interferences with his plans, leading to the impression among his subordinates that their superiors were vacillating and wanted confidence in the enterprise. An epidemic of yellow fever broke out, creating a panic which was with difficulty prevented from becoming a stampede. In the midst of these conditions, Mr. Wallace amazed the country by resigning his position without warning.

The change in the management of the Canal operation had been made largely with a view to giving to the Chief Engineer the greater degree of independence and responsibility which he had demanded. He had expressed himself as quite satisfied with the new arrangement, but it had hardly been in force two months when he threw up his position without any adequate explanation.

The resignation of Mr. Wallace was promptly accepted, and John F. Stevens, a railroad engineer with a fine record, was appointed in his place. Mr. Stevens had the advantages of wide experience, strong personal magnetism, executive ability, and the faculty of judging and handling men. His first step was to secure the services of several young engineers who had worked under him in the West. He then proceeded to a thorough organization of the force and effected it in a comparatively short while. For the first time the operation took on an aspect of definite progress.

The question of the type of canal to be constructed still remained to be settled. The President determined to seek the advice of the leading authorities in the world and to that end invited several foreign governments to name

members of an international board to whom the matter should be submitted.

The International Board of Consulting Engineers met at Washington in August, 1905. The members were: Henry Hunter, Chief Engineer of the Manchester Ship Canal (nominated by the British Government); Adolph Guerard (nominated by the French Government); Eugene Tincauser (nominated by the German Government); J. W. Welcker (nominated by the Government of the Netherlands); M. L. Quellenec, Consulting Engineer of the Suez Canal; Gen. G. W. Davis (a former member of the Isthmian Canal Commission); Alfred Noble, Chief Engineer of the Pennsylvania Railroad; William B. Parsons (a former member of the Isthmian Canal Commission); W. H. Burr (a former member of the Isthmian Canal Commission); Frederick P. Stearns, a leading hydraulic engineer, Gen. Henry L. Abbott (formerly a member of the *Comité Technique*); Joseph Ripley, Engineer of the Sault Ste. Marie Canal; Isham Randolph, Engineer of the Chicago Drainage Canal. Thus there were five foreigners and eight Americans, each of them a man well qualified to study and pass judgment on the question at issue.



CROSS SECTION OF PEDRO MIGUEL LOCK, SHOWING LATERAL CULVERT FORMS IN PLACE, JAN. 5, 1910.



mission, which were then in Washington, the Board of Consulting Engineers spent several weeks at the scene of operations. .

The report of the International Board of Consulting Engineers was submitted in February, 1906. It was a voluminous and able document, the most important feature of which was the recommendation by a majority of the members of a canal at sea level. This conclusion was reached by the five foreign members and General Davis, Professor Burr and Mr. Parsons. The remaining members favored a multi-lock canal.

The decision of the Board, which was a purely advisory body, disappointed the President and he determined to make a contrary recommendation to Congress. In this he had the support of the present Isthmian Canal Commission, and its predecessor, of Secretary Taft, and Chief Engineer Stevens, each of whom put his argument into documentary form.

The arguments on which the majority of the Board based their reports were disputed by their dissenting colleagues and by many other eminent engineers. The chief of them was founded on a belief that the large locks which would be necessary could not be constructed

and operated with safety. On this point American opinion is generally conceded to be of greater weight than that of foreign engineers because here the experience has been more extensive than abroad. The engineers who should know most about the subject proclaimed their absolute confidence in the feasibility and safety of the largest locks that were taken into consideration.

The law left the President power to proceed with the Canal according to his best judgment. If he had endorsed the sea level project he must have applied to Congress for a larger appropriation with which to carry it out. As he did not do so, the matter was allowed to remain in *statu quo* and, as the Spooner Bill had clearly contemplated a multi-lock canal, the work was proceeded with along those lines.

CHAPTER VII

THE CANAL AS IT WILL BE

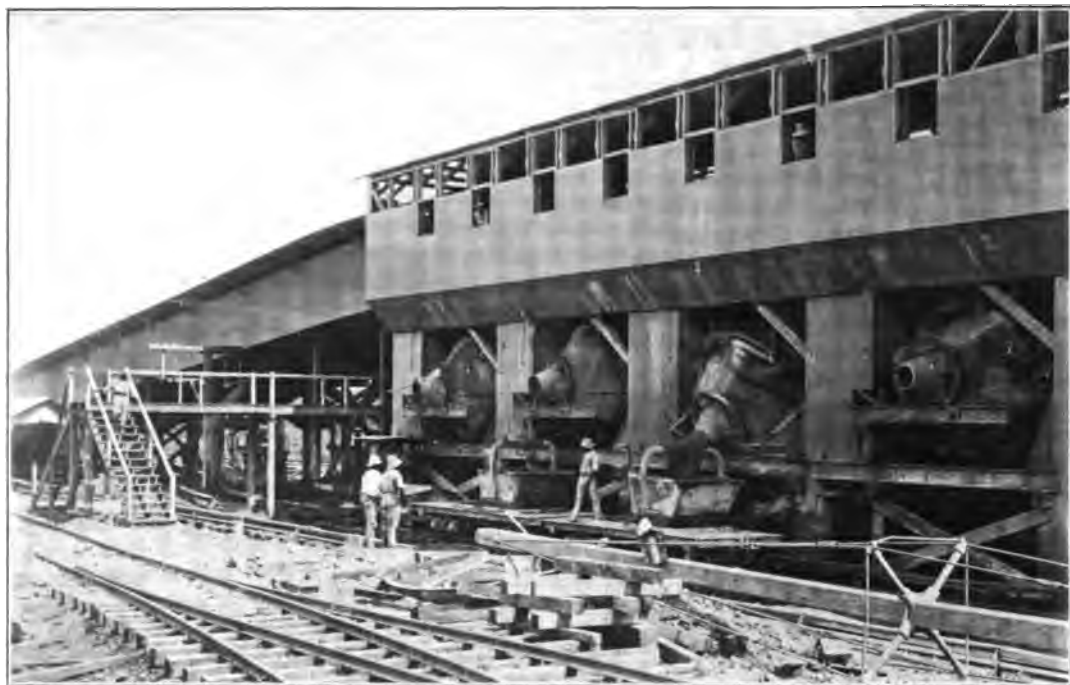
IN submitting its report, the minority of the Board of Consulting Engineers expressed the belief that a lock canal is the better one for the United States to construct for the following reasons: 1. Greater capacity for traffic than afforded by the narrow waterway proposed by the Board. 2. Greater safety for ships and less danger of interruption to traffic by reason of the wider and deeper channels which the lock canal makes possible at small cost. 3. Quicker passage across the Isthmus for large ships or a large traffic. 4. Materially less time required for construction. 5. Materially less cost.

This report included a detailed plan for a canal which, in many important features, conformed to that of the Commission of 1899-1901. In the former, however, the dimensions are increased, the main dam is placed at Gatun, instead of at Bohio, and the terminal lock on the

Pacific side is moved from Miraflores to Sosa. This is in the main the plan upon which the work is being carried to a conclusion. The chief deviations from it are, the return of the terminal lock to its former site at Miraflores, and a general increase in the dimensions.

The plan, briefly stated, involved a channel commencing well out in the harbor in the Bay of Mindi, and continuing at sea level to Gatun. Here a large artificial lake was to extend to Obispo, where the passage of the Culebra Cut begins. At Pedro Miguel the summit level terminated with a set of locks and a smaller lake extended to Sosa, where sea level was again reached by the channel, which continued out into the harbor.

The bottom of the channel under this plan would lie at 40 above sea level for the greater part of the distance, and in the alternative plan for a tide level canal at 40 below, a difference of 80 feet. This entire difference would be saved in excavation where the ground stands at an elevation of 40 feet or over. But, as the lock plan contemplates a much broader channel, the disparity in the quantity of work required by each is somewhat lessened. From Gatun for about 20 miles through the lake practically



CONCRETE MIXING PLANT, GATUN.



no earth needs to be removed in order to get the requisite depth of channel. In the Culebra Cut the excavation for the sea level canal would have to be carried a clear 80 feet, most of it through hard material, deeper than that for the lock canal.

The principal feature of this plan is the great dam at Gatun which is to be thrown across the channel of the Chagres River. The waters thus intercepted in their course to the sea will collect in the valley basin and form the huge artificial lake. The lake will also furnish water for the lockages and for power, while affording practically open navigation through the greater part of its length.

The dam is to be an enormous solid structure, calculated to withstand the forces of nature and, as the report states, one that "could only be destroyed by making excavations which would require a large force working for a long time." The crest of this dam, as planned, stands at 135 feet elevation, or 50 feet above the summit level of the lake; at the top it is 100 feet in width, and at water level, 374 feet; at its base it is 2,625 feet, or one-half mile, in thickness. These dimensions have been somewhat changed.

This dam will have a face, reinforced with riprap, extending a distance of one and a half miles and connecting two hills. A rock wall along its foot will parallel the face. These rock structures, together with the flanking hills, will form a kind of box. Specially selected material, consisting of clay and sand carried in water, will be pumped into this enclosure, and when the water has drained off, there will be left a compact and hard mass, impervious to seepage. Near the centre of the face a spillway, with sluice gates, will permit of the regulation of the stand of water in the lake.

It is confidently expected that this massive structure, being, as it were, welded into the earth at bottom and along its sides, will withstand any earthquake to the force of which it is likely to be subjected. It will be much stronger than the dams at San Leandro and Pilarcitos, connected respectively with the waterworks of Oakland and San Francisco, which are at present the largest in existence. The latter was not in any degree injured by the great earthquake of San Francisco, although it lay within the zone of disturbance. "This huge mass will exert a pressure upon its foundation of one ton to the square foot for every

twenty feet of its height. Its great weight will be an element of safety, provided the foundation is not susceptible to percolation. The Gatun Dam is the key to the plan, and its importance has made its site the centre of the critical investigations to which the plan has been subjected continuously since its inception. Borings innumerable have been made during the past four years, and it is safe to say that our engineers are as familiar with the underlying strata as they are with the surface of the ground. The fund of applicable data has been enlarged by the construction of experimental dams, by soil analysis, by water tests, and by geological examinations. In short, the dam and lock sites at Gatun have been explored exhaustively, and from every possible point of contact. The results show conclusively: (1) That the foundations are suitable, and perfectly safe for the construction of a stable and water-tight earth dam of such material as is available and near at hand. (2) That the concrete spillway and concrete locks will rest upon rock foundations of the most satisfactory description.”¹

This dam has been made the object of the

¹ From an article by the Author in the Review of Reviews, April, 1909.

severest criticism by the advocates of a sea level canal. The wildest misstatements have been disseminated regarding it and an attempt has been made to create the impression among the public that it is experimental in its nature and that the engineers in charge of the work have comparatively little knowledge of the ground upon which the dam is to stand. A trivial slide, such as engineers always look for in fills before the material has finally settled, was eagerly seized upon as a basis for a sensational report that a serious cave-in had occurred. One of the newspapers printed an absurd story to the effect that a subterranean lake had been disclosed. The matter was made so much of by a large proportion of the press that public confidence was seriously impaired and the President determined to appoint a special commission to investigate. The body was composed of engineers whose experience was particularly great in the matter of dams. After ten days of investigation on the spot, the Commission reported that the dam, its plan, site, and the material that was to be used in its construction, were all that could be desired.

The water supply is, of course, a matter of the utmost importance. The subject was



LAYING SIDEWALL CULVERTS, WEST CHAMBER, PEDRO MIGUEL LOCKS, MARCH 3, 1910.



treated by General Abbott, an unquestionable authority, in a separate paper which was embodied in the report. The records of the flow of the Chagres and its tributaries during fifteen years showed 1,250 feet per second in the driest seasons. On a conservative estimate, 2,577 feet per second can be depended on during the entire three months of least rainfall.

“ To determine the number of lockages which this quantity of water will provide for, the following provisions and assumptions have been made: Intermediate gates are to be provided for at Pedro Miguel and Sosa, so as to give a chamber length of 600 feet (the full length of the lock being 900 feet), and it is assumed that the intermediate gates will be used for eight-tenths of the lockages. . . . It is further assumed that all ships passing in one direction will use one set of locks and all ships passing in the other, another set. (All the locks on the Canal are to be in duplicate.) On this assumption the same quantity of water is used whether a ship passes through a single lock or through two or three in flight. The lift to the normal level at Pedro Miguel is 30 feet and at Gatun 28.50 feet per lock. The quantity of water required per lockage at Pedro Miguel, on the as-

sumption that intermediate gates will be used eight-tenths of the time, is 22.13 cubic feet per second, and the quantity per lockage at Gatun 29.77 cubic feet per second, making a total of 51.90 feet per second. The net available quantity of water is, as already stated, 1,350 cubic feet per second, and will therefore provide for 26 lockages per day at each lock in the driest season."

It is expected and hoped that the traffic will, at no great distance of time, demand a greater number of lockages than the maximum provided for. The present Engineer in Chief is of the opinion that this will come about so soon as to justify the inclusion of an extension of the water supply in the operations now in progress, more especially as a great saving in cost would be effected thereby. He favors the Alhajuela dam and reservoir, which was proposed by the *Comité Technique*, and which will supply enough water for about thirty additional lockages.

The surface of the Canal, at 85 feet elevation, is the summit level, which is maintained beyond it through the Culebra Cut, a total distance of about 32 miles. The plan of the Board provided for a triple flight of locks in duplicate at

Gatun, by means of which vessels would rise from the channel at sea level to the lake. These locks would permit of two ships passing through them at the same time, and would have the additional advantage that, in case of one set being put into temporary disuse, traffic could be continued through the other. The dimensions of the locks throughout the Canal were to be 900 feet clear length, 95 feet usable width, and 40 feet depth over the miter sill.

Of the total length of the land channel, about 41 miles, more than half lies within the lake, where a broad and deep way is available. The greater part of the Canal course is along straight lines. There are no sharp curves and where changes of direction occur, the outer lines of converging courses are carried to an intersection and the point of the inner angle dredged off, so that a curve of 8,000 or more feet radius can be laid down wholly within the channel. The channel will be nowhere less than 300 feet at the approach to a curve, nor less than 600 feet within it.

The Board's dimensions gave a channel in the Culebra Cut as narrow as 200 feet in places. On the farther side of the Cut the greatest changes that have been made from the plan of



BIRD'S-EYE VIEW OF THE CANAL DISTRICT.



300 feet, to Pedro Miguel. There it will enter a lock and be lowered 30 1-3 feet to a small lake, at an elevation of 54 2-3 feet above sea level, and will steam through this for about 1½ miles to Miraflores. There it will enter two locks in series and be lowered to the sea level, passing out into the Pacific through a channel about 8½ miles in length, with a bottom width of 500 feet. The depth of the approach channel on the Atlantic side, where the tidal oscillation does not exceed 1½ feet, will be 41 feet at mean tide, and on the Pacific side, where the maximum oscillation is 23 feet, the depth will be 45 feet at mean tide.

The Gatun Dam, which will form Gatun Lake by impounding the waters of the Chagres and other streams, will be nearly 1½ miles long, measured on its crest, nearly ½ mile wide at its base, about 400 feet wide at the top, and its crest, as planned, will be at an elevation of 115 feet above mean sea level, or 30 feet above the normal level of the Lake. The interior of the Dam will be formed of a natural mixture of sand and clay, dredged by hydraulic process from pits above and below the Dam, and placed between two large masses of rock and miscellaneous material, obtained from steam shovel

excavation at various points along the Canal. The top and upstream slope will be thoroughly ripped.

The Spillway is a concrete lined opening, 1,200 feet long and 300 feet wide, cut through a hill of rock nearly in the centre of the Dam, the bottom of the opening being 10 feet above sea level. During the construction of the Dam, all the water discharged from the Chagres and its tributaries will flow through this opening. When construction has sufficiently advanced to permit the Lake to be formed, the Spillway will be closed with a concrete dam, fitted with gates and machinery for regulating the water level of the Lake.

The water level of Lake Gatun, extending through the Culebra Cut, will be maintained at the south end by an earth dam connecting the locks at Pedro Miguel with the high ground to the westward, about 1,700 feet long, with its crest at an elevation of 105 feet above mean tide.

A small lake between the locks at Pedro Miguel and those at Miraflores will be formed by dams connecting the walls of Miraflores locks with the high ground on either side. The dam to the westward will be earth, about 2,700



LOOKING SOUTH FROM THE EAST WALL, UPPER GATUN LOCK, MARCH 1, 1910.

feet long, having its crest about 15 feet above the water in Miraflores Lake. The east dam will be of concrete, about 500 feet long, and will form a spillway for Miraflores Lake, with crest gates similar to those at the spillway of the Gatun Dam.

Gatun Lake will cover an area of 164 square miles with a depth in the ship channel varying from 85 to 45 feet. Throughout the first 16 miles from Gatun, the width of the channel will be 1,000 feet; then for 4 miles, it will be 800 feet, and for 4 miles more 500 feet, when the entrance to the Culebra Cut, at Bas Obispo, will be reached. The water level in the Cut will be that of the Lake, and the bottom width of the channel will be 300 feet.

The territory through which the Canal runs is called the Canal Zone. It contains about 448 square miles. It begins at a point three marine miles from mean low water mark in each ocean, and extends for five miles on each side of the centre line of the route of the Canal. It includes the group of islands in the Bay of Panama named Perico, Naos, Culebra, and Flamenco. The cities of Panama and Colon are excluded from the Canal Zone, but the United States has the right to enforce sanitary ordi-

nances in those cities, and to maintain public order in them in case the Republic of Panama should not be able, in the judgment of the United States, to do so.

There will be 12 locks in the Canal, all in duplicate; three pairs in flight at Gatun, with a combined lift of 85 feet; one pair at Pedro Miguel, with a lift of $30\frac{1}{2}$ feet, and two pairs at Miraflores, with a combined lift of 54 2-3 feet at mean tide. The dimensions of all are the same — a usable length of 1,000 feet, and a usable width of 110 feet. Each lock will be a chamber, with walls and floor of concrete, and watertight gates at each end.

The side walls will be 45 to 50 feet wide at the surface of the floor; will be perpendicular on the face, and will narrow from a point 24 1-3 feet from the floor until they are 8 feet wide at the top. The middle wall will be 60 feet wide, approximately 81 feet high, and each face will be vertical. At a point 42 1-3 feet above the surface of the floor, and 15 feet above the top of the middle culvert, this wall will divide into two parts, leaving a space down the centre much like the letter U, which will be 19 feet wide at the bottom. In this centre space, which will be 44 feet wide at the top, will be a tunnel divided



**LOOKING SOUTH FROM PEDRO MIGUEL LOCK SITE, SHOWING CONSTRUCTION OF THE LOWER
MIDDLE APPROACH WALL, JAN. 5, 1910.**



into three stories, or galleries. The lowest gallery will be for drainage; the middle, for the wires that will carry the current to operate the gate and valve machinery, which will be installed in the centre wall; and the upper will be a passageway for the operators. The lock chambers will be filled and emptied through lateral culverts in the floors, connecting with main culverts, 18 feet in diameter, in the walls, the water flowing in and out by gravity.

The lock gates will be steel structures 7 feet thick, 65 feet long, and from 47 to 82 feet high. They will weigh from 300 to 600 tons each. Ninety-two leaves will be required for the entire Canal, the total weight being 57,000 tons. Intermediate gates will be used in the locks, in order to save time and water, if desired in locking small vessels through, the gates being so fixed as to divide the locks into chambers 600 and 400 feet long respectively. Ninety-five per cent of the vessels navigating the high seas are less than 600 feet long. In the construction of the locks it is estimated that there will be used approximately 4,500,000 cubic yards of concrete, requiring about the same number of barrels of cement.

No vessel will be permitted to enter or pass

through the locks under its own power. Electricity will be used to tow all vessels into and through the locks, and to operate all gates and valves, power being generated by water turbines from the head created by Gatun Lake.

The time required to pass a vessel through all the locks is estimated at three hours, one hour and a half in the three locks at Gatun, and about the same time in the three locks on the Pacific side. The time of passage of a vessel through the entire Canal is estimated as ranging from ten to twelve hours, according to the size of the ship, and the rate of speed at which it can travel.

The total excavation, dry and wet, for the Canal, as originally planned, was estimated at 103,795,000 cubic yards, in addition to the excavation accomplished by the French companies. Changes in the plan of the Canal, made subsequently by the order of the President, increased the amount to 174,666,594 cubic yards. Of this amount, 89,794,493 cubic yards were to be taken from the Central Division, which includes the Culebra Cut. Active excavation work on a large scale did not begin until 1907, when 15,765,290 cubic feet were removed. In 1908,

over 37,000,000 cubic yards were removed, and in 1909, over 35,000,000, making a total for the two years of over 72,000,000 cubic yards, or a monthly average for those two years of 3,000,000 cubic yards. The total of those two years was nearly half of the entire excavation for the Canal. On April 1, 1910, the excavation exceeded 103,000,000 cubic yards, nearly the entire amount called for in the original plan. The French companies had excavated 78,146,960 cubic yards, of which 29,908,000 cubic yards were useful in the present plan of construction.

The statement, which was issued in the first half of 1910, contains a summary of expenditures, which makes interesting reading when compared with the similar statement of the Panama Canal Company.

APPROPRIATIONS

Payment to the New Panama Canal Company	\$40,000,000
Payment to Republic of Panama	10,000,000
Appropriation for 1902	10,000,000
Appropriation for 1906	11,000,000
Deficiency for 1906	5,990,786
Appropriation for 1907	25,456,415
Appropriation for 1908	27,161,367
Deficiency for 1908	12,178,900
Appropriation for 1909	29,187,000
Deficiency for 1909	5,458,000
Appropriation for 1910	33,638,000
	<hr/>
	\$210,070,468





tion and perfect discipline have been conspicuous features of the new regime. The work has been pushed with a thoroughness and speed that exceed the expectations of Secretary Taft and others who had the utmost confidence in the ability and energy of Colonel Goethals and his aides. There has been no friction on the inside and the work has gone steadily forward during the two years that the present Commission has had the control and direction of affairs.

Until comparatively recent years, the Isthmus of Panama was a hotbed of disease. Dr. Wallace, writing in 1882, declares that, while the actual sanitary condition of the ports of Colon and Panama was comparatively good at that time, it is "well known that small-pox, the yellow fever and the paludal fevers, in their infinite varieties and forms, never are absent in these tropical regions where they are truly endemic."

In September, 1884, the harbor of Colon was full of shipping, among which yellow fever appeared. A British brig lost all her crew but the cook. Other vessels lost in the aggregate upwards of twenty men. In Colon there were one hundred and seventy cases, with a mortality of more than two-thirds. During the same

month the Canal Company buried six hundred and fifty-four of its force. Such epidemics were of frequent occurrence in the period preceding the American occupation. It rarely happened that five years passed without a severe outbreak of yellow fever, and sporadic manifestations of the disease were too common to excite notice. A large proportion of the natives appear to be immune, but the presence of any considerable number of strangers from northern latitudes invariably marked the occurrence of an epidemic of yellow fever. Malaria was rife and even less notice was taken of it. The local authorities did nothing whatever to improve conditions, but, in fact, rather induced the spread of disease by their indifference to sanitary measures. The French companies did their best, under the circumstances, to prevent the increase of disease, and their provision for the care of the sick was admirable, but it was not until the Canal passed into our hands that effective measures for permanent sanitation were put into effect.

It would be impossible to overrate the splendid work which has been done by Colonel Gorgas and his assistants. They produced conditions in which Americans can, by the exercise of or-

dinary discretion, maintain good health in connection with hard work. They have greatly reduced the mortality and sickness among the laborers, and so have proportionally increased the general efficiency of the force. In short, they have converted the entire Canal Zone, including the cities of Colon and Panama, into a region where the dangers and discomforts of living are decidedly less than those that generally prevail in the tropics. It is now admitted that the climate, while enervating, is not in itself especially harmful. Indeed, as will presently be shown, the vital statistics for the present time compare favorably with those of the most healthful portions of the United States.

Without this improvement in sanitation, the work could have been done, if at all, only at great loss of life and health, not to mention an excessive consumption of time. The medical officers responsible for sanitation recognized this from the first, and urged the necessity of subordinating everything else to the improvement of health conditions, but they were not represented on the Commission until the later appointment of Colonel Gorgas as a member. The members of the Walker Commission were not unappreciative of this point of view, but

they could not withstand the impatient demands of the American press that the dirt should be made to fly without delay. It is much to the credit of the sanitary officers that, under discouraging circumstances, they pursued their efforts uncomplainingly and with unimpaired zeal.

The Shonts Commission determined to devote its chief energies at the outset to cleaning up the Zone and pushing the sanitation work, realizing that when the health and comfort of the force should be provided for, the work of construction would proceed with fewer casualties, and at a greater rate of speed than if it were to be pushed ahead without such preliminary work.

All along the line of the Canal a campaign was instituted against the two species of mosquito that convey respectively yellow fever and malaria. The experience of Colonel Gorgas and his associates in Cuba enabled them to attack this task with a definite and effective plan. This, whilst simple in its essential features, entailed a vast amount of labor. Since the malaria mosquito can only become infected by sucking the blood of a sufferer from that disease, it was evident that by placing as many of the victims

as possible beyond reach of mosquito bite, the insect's source of germ supply would be greatly reduced. Wherever malarial subjects could be found within the Zone, they were isolated in screened rooms until the parasite had been eliminated from their systems. Such, at least, was the aim of the sanitary officers, but it may easily be imagined that a plan of this sort could not be carried out with anything like thoroughness.

At the same time, work was directed toward the destruction of the breeding places of the insects. All along the line long grass and rank vegetation was cut down, marshes were drained, pools were sprinkled with oil, dwellings were cleansed, and stagnant water everywhere removed. This campaign involved an enormous amount of labor and close supervision, but the results have amply justified all the trouble and expense. At the inception of the work, Colonel Gorgas said, referring to similar efforts in Havana: "At the end of about eight months of this work it was found that the number of yellow fever mosquitoes had been greatly decreased, and those that were left could find no human being infected with yellow fever, whereby they, the yellow fever mosquitoes,

might become infected, and thus convey it to other human beings. For the past three years Havana has been free from yellow fever. An unacclimated man can go to Havana now, and though he may probably be bitten a good many times by yellow fever mosquitoes, these mosquitoes have had no opportunity in the past three years of biting a human being infected with yellow fever, and therefore are themselves entirely harmless. This condition we hope to bring about in the villages along the canal route by means similar to those adopted in Havana."

Another interesting quotation from the same source bears on the general health and climatic conditions at Panama. It should be borne in mind that the utterance was given about the middle of the year 1905, since which time the "hope and expectation" expressed by the Chief of the Department of Sanitation have been more than fulfilled.

"The Panama strip is now about as healthy as the ordinary tropical country. The death rate is a great deal higher than that in New York, but this would be the case almost anywhere in the tropics. About twenty people per thousand in New York die every year and about fifty per thousand in Panama. The general

idea about Panama seems to be that we shall suffer as the French did and as all European venturers in Panama did, and that, instead of dying as we do in New York, at the rate of twenty per thousand per year, we shall die, as sometimes occurred to the French and others at Panama, at the rate of five or six hundred per thousand per year. Other men of experience in the tropics, and who have been at Panama for some time, maintain that the matter of sanitation is exceedingly simple and easy, and that the health of the Panama strip ought to be as good as that of most parts of the United States. Both opinions, it seems to me, are extreme, and the truth will fall somewhere between the two. Any health officer with experience in dealing with a practical question of this kind will know how exceedingly difficult it will be in a population of about fifteen thousand (that is the population of the villages along the Canal line) people infected with malaria to devise and apply any system by which the cases can be individually recorded and treated. Personally I approach the problem with hope and expectation of having approximately the same success that rewarded similar efforts applied by our military authorities in Cuba. But it is

no simple matter. We shall, no doubt, meet with disappointments and discouragements, and shall succeed in the end only after many modifications of our plans and after many local failures.”

Before describing the present health conditions in the Zone, it will be well, by way of furnishing a comparison, to give a brief statement of what they were during the period of French occupancy. The first work on the Canal was done in 1881, but few men were employed until the following year, when the force numbered nearly 2,000. It was gradually increased until in 1884 the average number of laborers carried on the pay rolls was 17,635. During the eight years in which the operation was carried on by the Panama Canal Company and its successor, an aggregate of 86,812 men were employed, giving an annual average of 10,881. The number treated for illness was 52,814. The number of deaths was 5,627, giving an average per year of 6,535 sick and 703 deaths in a force of less than 11,000.

At the present time all classes of employes on the Canal are comfortably housed and furnished with wholesale food at low cost. In fact, the majority of them live under conditions con-

siderably better in this respect than they would enjoy at home. Extensive provision is made for their recreation, including several club houses at different points operated by the Young Men's Christian Association.

During the year 1908, the death rate among an average white force of 12,058 was 15.34 per one thousand; and among the 5,000 American employes, 8.14 per one thousand. In the force of blacks, averaging 31,000, the mortality was 19.48 per thousand, or less than the average of the City of New York.

During the year 1909, the health conditions in the Zone showed an improvement over the preceding year. The total admissions of employes to hospitals and sick camps, including those sick in quarters, amounted to 46,194, representing for the year 23.49 as the number of men sick daily out of every thousand names on the pay rolls, as against 23.85 for the preceding year. This is a percentage of considerably less than 3, and the majority of the cases were of trivial consequence. The total number of deaths was 530, and assuming that the average number of names on the pay rolls for the various months of the year amounted to 44,261, the number of deaths would be equivalent to a

rate of 11.97 per thousand, as against 18.32 for the preceding year.

This truly wonderful showing is the more remarkable when it is considered that a large proportion of the West Indian laborers who are imported arrive in an underfed condition and many of them suffering from disease. In great degree the improvement in the vital statistics is attributable to the fact that in recent years the negroes have been compelled to take good and sufficient food under the ration regulations. Formerly the matter of food was left entirely to themselves, with the result that many ate irregularly and insufficiently.

The gold employes are compelled to take six weeks vacation in each year, during which full pay is allowed. Until recently they were required to go out of Panama for their holiday, but since the Commission has learned to appreciate the salubrious climate and healthful conditions of the Province of Chiriqui, employes have been allowed to spend their vacations there, if they desire. The establishment of a sanitarium in Chiriqui for the sick and convalescent is under consideration.

Exercising the right acquired under the treaty with the Republic of Panama, the Com-

mission made the most extensive improvements in the terminal ports. Both cities have been paved, cleansed, and supplied with sewer and water systems. In fact, they have been so transformed that they bear little resemblance to the foul and unsanitary centres we found on our arrival at the Isthmus. This work was dictated by practical business policy and an agreement provides for the repayment of the cost of it by the Republic. Had Panama and Colon been left in their former state, the sanitation of the Zone could not have been of much avail. Furthermore, unless these ports are entirely divested of their old reputation as foci of disease, when the Canal is opened to commerce, shipping will take an alternative route whenever that is possible.

When we took over the Canal, the City of Panama was a dirty town of narrow streets, paved with cobble stones. It had neither water nor sewer systems, and the streets were imperfectly drained by means of gutters which were frequently clogged by refuse. The population depended for its water supply upon barrels and cisterns, which were the most favorable breeding places possible for the stegomyia, or yellow fever mosquito. The patios of the

houses were generally littered with rubbish and few persons thought of disinfecting the cess-pools.

The cemeteries, which will be described elsewhere, were another serious menace to health. The habits of the majority of the inhabitants were conducive to disease. In short, the conditions in the city were such that the wonder was that death and sickness were not more prevalent among its people.

The Island of Manzanillo, on which the city of Colon stands, is in part below the level of the sea and nowhere more than four feet above it. At high tide considerable portions of it were flooded. This condition precluded the presence of any adequate system of drainage and this city, like Panama, lacked water and sewer services, except for that small section which was occupied by the dwellings of the officials and white employes of the Railroad. This was supplied with water of indifferent quality from a reservoir near Mount Hope, in the vicinity of the cemetery. As for the rest of the population, they enjoyed, if possible, even a less degree of sanitary convenience than the people of Panama.

In both cities the campaign against the mos-

quito was vigorously carried on in the face of protests by the beneficiaries, who seemed to consider the risk of yellow fever preferable to the discomfort of fumigation. Excellent water supplies were instituted, and all uncovered receptacles for water were thereafter forbidden. The streets of Colon and Panama were paved, and much of the Island of Manzanillo was filled in and drained. An adequate sewer system has been installed in each city, and a good fire department is now established in Panama. Only those who knew these cities at the time of the French occupation can fully appreciate the wonderful transformation that has been effected in them.

In a public address, delivered in August, 1909, Mr. H. H. Rousseau of the Isthmian Canal Commission thus summed up the work of the Sanitary Department:

“The work of the Sanitary Department, under the member of the Commission who has been its head since its organization, has been phenomenally successful, and, by removing the cloud which rested over the Isthmus from its unsanitary and extremely unhealthful condition, and thus making it possible for Americans to live and work there in health and happiness,

it has performed a service of inestimable value toward the construction of the Canal. The present condition has been reached only by persevering hard work. There have been 135 cases but since 1905, nearly four years ago, not a case of yellow fever among employes and 34 deaths, has been known. Similar success has attended the fight against malaria. In 1904, three-fourths of the Zone population were infected with malaria, and in the early days of Canal construction the number of employes treated for malaria in hospitals in a year averaged over 80 per cent of the whole number. It is scarcely one-third of this at present. In the last three years the hotel sick rate of employes has been reduced more than one-half, and the death rate more than two-thirds.

“ Over 1,200 men are carried on the pay rolls of the Department of Sanitation, and the expenditures amount to \$2,000,000 per annum. It will require constant work and unceasing vigilance to keep health conditions up to the standard which has been established. The total expenses of the Sanitary Department will amount, it is estimated, to about \$20,000,000, or a little over 5 per cent of the total cost of the

Canal. Of the total expenditures of the French, less than \$2,000,000, or hardly one-half of one per cent, was charged up to hospital service, and practically nothing to sanitation.”