Systematic Observation

BEFORE the departure from Charleston, Lucien Wulsin, Chairman of the Committee of Arrangements for the Commercial Club of Cincinnati, obtained from Washington a number of maps, official reports and addresses of recent dates upon the Panama Canal. The wisdom of this provision was seen in the demand for the latest official information on the Canal which developed among the members before the steamer was three days out from Charleston. Mr. Wulsin had also thoughtfully corresponded with officials at Washington, notably Mr. Shonts, seeking to outline, tentatively at least, a program to make the visit to the Canal Zone as effective as possible within the limits of the time allowed. In this correspondence it had been made clear that the members of the Clubs would pay all of their expenses while on the Isthmus, but would appreciate help in making their observations of conditions and progress comprehensive and thorough.

Mr. Shonts had sent to Mr. Wulsin the following suggestions for a program, forwarded by Chief Engineer Stevens:

"I would suggest that on their arrival in Colon early in the morning they can be taken to Panama on a special train, accompanied by some of our officials who will explain all points of interest and give them an idea of the whole lay-out en route.

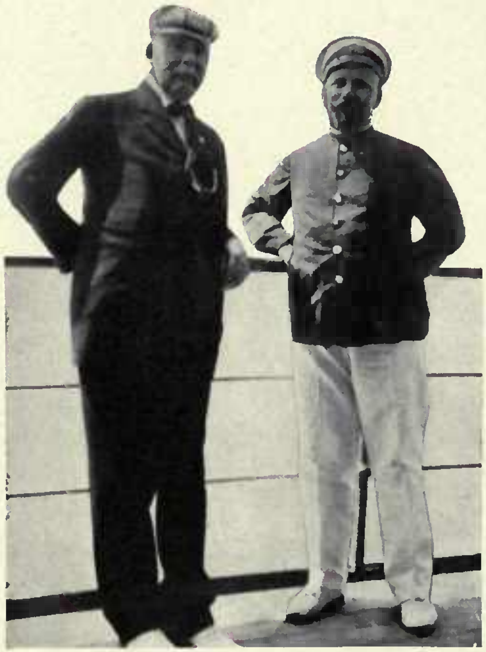
"Then, after luncheon at the Tivoli, they can be shown around over Ancon and Panama, with possibly a trip around the harbor and islands on the 'BOLIVAR' in the afternoon.

"Making an early start the next day by special train, take them through the Cut and over the Panama Railroad, stopping at or visiting all points of interest, including the lock sites, big cuts, sites of the dams, railroad terminals at Cristobal, and other points of interest; and I believe we can arrange to give them luncheon at one of our eating-houses on that day.

"The program of the first day, of course, would include visiting La Boca and covering explanation of dam and lock sites at that point."

The day after the departure from Charleston the Joint Committee took up the matter of the program to be followed on the Isthmus. Upon the suggestion of Mr. Lucien Wulsin, a Committee on "Observation of the Canal" was named to prepare the program and to report it to a general meeting of members of the Clubs. This Committee was composed of Lucien Wulsin, Chairman, of Cincinnati, and one member of each Club — Elihu Thomson, of Boston, Cyrus H. McCormick, of Chicago, Lawrence Maxwell, Jr., of Cincinnati, and Robert Moore, of St. Louis. The surgeon, Dr. Henry S. Warren, of Boston, and the press representative, Walter B. Stevens, of St. Louis, were attached to the Committee to render such assistance as might be desired — the surgeon to advise on hygiene and sanitary questions, and the press representative to act as secretary.

Talking about the day's run — Charles W. Knapp and Captain von Leitner.



The Committee held several meetings before a report was ready for submission. This report outlined a proposed program for the two days on the Isthmus, and recommended a plan of organization or division of the members into eight groups to give special attention to as many subjects. The Committee reported favorably upon Chief Engineer Stevens' suggestion, and added to it the following:

"That in Panama a dinner be given at Hotel Tivoli at 7 o'clock on the evening of the first day, to which guests to be selected by Mr. Stevens, up to one hundred, should be invited in the name of the Clubs.

"That luncheon on the second day at one of the eating-houses be the same as is given to their men.

"That on the evening of the second day an informal dinner be given on board the 'PRINZ JOACHIM', with guests not exceeding fifty.

"That the first afternoon be arranged so that members can for two hours, as they like, stroll about the City of Panama, see the sights and visit the shops; and that on the second day, if possible, we run up the Canal in launches.

"That as members are in eight groups, according to the subjects that interest them, the groups keep together in landing so as to meet the officials especially able to give them information desired."

With some minor modifications and with changes in the order of things, found to be advisable after the landing at Colon, the main features of the program were carried out.

The Committee, of which Mr. Wulsin was Chairman, submitted its recommendations to a general meeting of members of the Clubs in the dining saloon on the 26th of February, the first evening after the departure from Porto Rico. Mr. Farwell, Vice-President of the Commercial Club of Chicago, presided.

Chairman Wulsin, addressing the assembled members of the Clubs, said the Committee had agreed on the following:

1. That we do not undertake to consider engineering problems already settled, but—
2. That we may properly consider:—
   Are labor conditions satisfactory?
   Is labor effective?
   Are conditions of living proper?
3. That our aim be not to assume finality of judgement but to form impressions as to conduct of the work.
   Is it being carried on properly and efficiently?
   Does the cost appear reasonable?

What are the sanitary conditions?

4. Our attention and thoughts should be directed to these questions by groups, and if we find material for criticism, it should be helpful, not destructive.

The Committee, the Chairman said, recommended the formation of groups of members upon the following subjects of special inquiry:

1. Sanitary and Hygienic Conditions.
2. Plan of Management.
3. Social and Racial Conditions, including Welfare and Ethical Questions.
4. Housing and Food.
5. Climate and its effects upon Americans.
6. Efficiency of Labor.
7. Progress of the Work.
8. Efficiency of the Plant, including the Railroad.

Elaborating the thought of the Committee in making these recommendations, Mr. Wulsin said:

"We go to Panama for the purpose of receiving impressions. To arrive at conclusions would require an amount of stuoy which it is impossible for us to give, but we can form impressions of what we see, which may have more or less value to ourselves and to those with whom we come in contact.

"The Committee therefore laid down the proposition that, in whatever studies we make on the Isthmus, there is one thing we must recognize, and that is that we do not, nor can we, undertake to consider and judge or pass upon engineering problems. We all know that the greatest engineers of the world were called in to consider the kind of canal to be built, and among them was considerable diversity of opinion. The engineering problems are now practically all settled, and we are certainly not going with any idea that we can form judgments on them.

"In making this visit to Panama, we are not going to be hypercritical, but shall endeavor to be helpful to our fellow-Americans who are engaged in that great work, whether as our friends, or simply as employees of the Commission. It has therefore been suggested —and I wish to repeat this—that we do not assume that we are going to Panama capable of forming judgments on this work from our two days of inspection, but we are going to form impressions. In doing this, if we would systematize our work of observation, we should proceed with order, so that each man may have a subject to which, so far as he is concerned, his special attention will be directed as a line of inquiry.

"From the brief thought I have been able to give this matter in a general way, it seems to me our questions, as we go along the Isthmus, should be such as these:

"How do you manage?

"How do you buy?

"How do you enable your men to do what they are called upon to do and what do they accomplish?

"How do you get your requisitions for stores and supplies filled without a delay of six weeks or more and a hundred yards of red tape—to get a pin, for example?

"Another point, however, in the special Committee's plan of dividing the members into groups in going across the Isthmus, is to associate with each group on the Isthmus the officials having charge of special lines of work, who will be able to inform them accurately and reliably on specific points, showing how the business is run and the work is done."

An interesting discussion of the Committee's recommendations ensued.

Mr. McCormick happily called the plan one of "systematic observation," and this was adopted as the best description of what was contemplated in the visit to the canal route.

Inquiries by Mr. Charles W. Knapp and Mr. Francis, of St. Louis, brought out a general expression of views by members.

Commenting on the recommendations, Mr. Moore, of St. Louis, said:

"Mr. Chairman, as I understand it, the purpose of this Committee in presenting this plan of organization, is to help us form impressions, and from such impressions, to draw conclusions, understanding that they are not authoritative—not final judgments, but such temporary judgments as the condition of the matter may warrant. Such judgments, although not final, I think are nevertheless very valuable."

The question being asked whether it was the purpose to give to the press the reports of the groups under the proposed plan, Mr. Crawford, of St. Louis, stated:

"I want to say emphatically that as far as I have talked over this matter with the Committee the question of publication is to be absolutely a subsequent matter. I am very sure that it is a second or third purpose, if one at all. The thought of the Committee was simply to provide the most effective and comprehensive method of acquiring information for the benefit of the members of this party, and having it for such dissemination as the members themselves may decide. The Group on Sanitation, for example, will inspect the quarters of the workmen, the water supply, street and sewage systems, and report what they found and what their opinion is concerning the same. The Group on Climate will make inquiries as to the kinds of weather that prevail, the seasons, and how the workmen are affected thereby. The Group on Efficiency of the Plant will examine and report on the machinery and tools and appliances in use, and the condition and operation of the railroad. I believe I am assigned to the Group whose duty it will be to look into Social and Racial Conditions and the ethical questions connected therewith. When we return to the boat from the trip across the Isthmus the several groups will submit their respective reports. That I am quite sure is the principal object; the matter of publication can take care of itself later. The plan appeals to me as an excellent one and I should, for my part, like to see it adopted."

Mr. Carter, of Boston, also strongly favored the proposed plan, saying:

"I certainly hope this plan will be carried out. It is a satisfaction to me to think that I can get the benefit of what the other members of this party will see on the Isthmus, as well as what I may see myself. Eighty sponges can absorb more than one sponge, and I want to take back the absorption of eighty sponges. I think this idea simply means planning in a systematic way the work we want to accomplish. We ought to know before we get to Colon, or at least by the time we arrive there, how we are going to work and what we are going to do, and when we get back to the ship each group will bring up its respective subject and we will discuss them in order. What the members of each group have to say will be only their personal opinions; we can then select what we want and when those selections are all boiled down that will be the report. It seems to me the committee is wise in saying that what we bring in will be only our impressions. I hope the plan the Committee has suggested will be approved."

Mr. Farwell, of Chicago, voiced his sentiments on the matter as follows:

"When Secretary Taft was in Chicago and made us a little speech, the impression we received was that we would make no formal report for publication, but would come back and say to our friends what we thought of the work and correct any false impressions that had gone abroad. The further the distance the greater the lie and the more difficult it is to refute it. A body of men like this, coming back and reporting to their friends what they saw, would do a great deal of good."

A strong advocate of the plan was Mr. Elihu Thomson, of Boston, who said:

"I must say that when I first heard that Mr. Wulsin proposed to have this organization effected I felt a great sense of relief. By dividing ourselves into groups, as suggested, we can each study and devote ourselves to a specific line of inquiry and investigation, and secure as much information as possible on that particular subject. To facilitate the getting of thorough and comprehensive information regarding this great undertaking, gentlemen, an organization such as this is essential. Otherwise a great number of us will ask the same questions and many questions will be overlooked altogether. After obtaining all this information we seek, if we come to different conclusions about it, that is another matter, but what we want is to get first the information. I think that everything to be said is in favor of an organization of this kind. With it, we go to the Isthmus in a systematic body and with a clear idea of what we are each to do."

The conclusion of the meeting was the unanimous adoption of the recommendations of the Committee, and the division of the members into groups as follows:

Group No. 1.

SANITARY AND HYGIENIC CONDITIONS.

Mr. Boit, Boston, Chairman.
Mr. Clow, Chicago,
Mr. Bremer, Boston,
Mr. Benj. Carpenter, Chicago,
Mr. Ryerson, Chicago,
Mr. Lodge, Cincinnati,
Mr. Warrington, Cincinnati,
Mr. H. P. Knapp, St. Louis,
Mr. Hill, St. Louis,
Mr. Geo. O. Carpenter, St. Louis,
Dr. Warren, Boston.

Group No. 2.

PLAN OF MANAGEMENT.

Mr. Wulsin, Cincinnati, Chairman,
Mr. Whitman, Boston,
Mr. Cumner, Boston,
Mr. Carter, Boston,
Mr. Baker, Chicago,
Mr. Morton, Chicago,
Mr. Rowe, Cincinnati,
Mr. Goshorn, Cincinnati,
Mr. Laws, Cincinnati,
Mr. Francis, St. Louis,
Mr. Chas. W. Knapp, St. Louis,
Mr. R. McK. Jones, St. Louis.

Group No. 3.

SOCIAL AND RACIAL CONDITIONS, INCLUDING WELFARE AND ETHICAL QUESTIONS.

Mr. Maxwell, Cincinnati, Chairman,
Mr. Hutchinson, Chicago,
Mr. Batcheller, Boston,
Mr. Minot, Boston,
Mr. Conover, Chicago,
Mr. Morron, Chicago,
Mr. Taylor, Cincinnati,
Mr. Ault, Cincinnati,
Mr. Campbell, Cincinnati,
Mr. Crawford, St. Louis,
Mr. George M. Wright, St. Louis.

Group No. 4.

HOUSING AND FOOD.

Mr. Knox, St. Louis, Chairman,
Mr. Burnett, Boston,
Mr. F. B. Carpenter, Boston,
Mr. Bartlett, Boston,
Mr. Carr, Chicago,
Mr. Swift, Chicago,
Mr. Langdon, Cincinnati,
Mr. Chatfield, Cincinnati,
Mr. Gamble, Cincinnati,
Mr. Dozier, St. Louis,
Mr. Nugent, St. Louis.

Group No. 5.

CLIMATE AS IT AFFECTS AMERICANS.

Mr. Schmidlapp, Cincinnati, Chairman,
Mr. Lawrence, Boston,
Mr. Cutler, Boston,
Mr. J. G. Wright, Boston,
Mr. Clark, Chicago,
Mr. Fuller, Chicago,
Mr. Goepper, Cincinnati,
Mr. Frank J. Jones, Cincinnati,
Mr. Mooney, Cincinnati,
Mr. Catlin, St. Louis,
Mr. Whitelaw, St. Louis.

Group No. 6.

EFFICIENCY OF LABOR.

Mr. Farwell, Chicago, Chairman,
Mr. Meacham, Cincinnati,
Mr. Dennison, Boston,
Mr. Mandell, Boston,
Mr. Cofran, Chicago,
Mr. MacFarland, Chicago,
Mr. Green, Cincinnati,
Mr. Worthington, Cincinnati,
Mr. Davis, Cincinnati,
Mr. Carleton, St. Louis.

Group No. 7.

PROGRESS OF THE CANAL WORK.

Mr. Moore, St. Louis, Chairman,
Mr. McCormick, Chicago,
Mr. Scott, St. Louis
Mr. Rice, Boston,
Mr. Noyes, Chicago,
Mr. Thorne, Chicago,
Mr. Yeiser, Cincinnati,
Mr. Egan, Cincinnati,
Mr. Durrell, Cincinnati,
Mr. Bixby, St. Louis.

Group No. 8.

EFFICIENCY OF THE PLANT, INCLUDING THE RAILROAD.

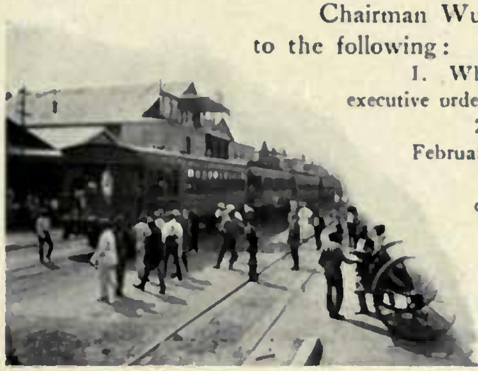
Mr. Thomson, Boston, Chairman,
Mr. Cowdery, St. Louis,
Mr. Dwight, Boston,
Mr. Russell, Boston,
Mr. Chalmers, Chicago,
Mr. Wilson, Chicago,
Mr. Omwake, Cincinnati,
Mr. Geier, Cincinnati,
Mr. Carew, Cincinnati,
Mr. Bascom, St. Louis,
Mr. Wells, St. Louis.

During the next two days the groups held meetings, talked over their respective subjects, and further sub-divided the lines of information to be sought. Brief reference to this preparatory work is interesting as showing the thoroughness which the groups applied to their observation. The Group on Sanitary and Hygienic Conditions, of which Mr. Boit, of Boston, was Chairman, sub-divided as follows:

Water Supply	Towns; Camps	Clow.
Drainage	Buildings; Working areas	Carpenter, G. O.
Plumbing	Inspection	Knapp, H. P.
Streets and Roads	Paving and Maintenance; Cleanliness	Warrington.
	Garbage—Removal and disposal; Inspection	Bremer.
House Sanitation	Materials; Space	Ryerson.
	Screening; Cleanliness	Lodge.
	Inspection	Hill.
General Sanitation	Hospitals and Dispensaries; Jails	Boit.
	Quarantine; Mosquitoes	Carpenter, Benj.
	Inspection	Warren.

Chairman Wulsin's Group on the Plan of Management determined to look especially to the following:

1. What changes have been made in the plan of organization outlined in the President's executive order of November 17, 1906?
2. Has any announcement been made since the Clubs sailed from Charleston, February 20th, regarding the letting of a general contract for the construction of the Canal?
3. Does political influence control or affect in any degree the appointment of officers and employees?
4. Are union labor organizations recognized, or their rules observed in any branch of mechanical work?
5. Does the eight-hour law apply to any line of work? If it does, is the effect beneficial or detrimental?
6. With a single executive head with authority over all departments, what check will there be on his acts?
7. If a general construction contract is not entered into, will it be necessary



The Start from Colon — Taking special train to cross the Isthmus to advertise for bids in the cases of purchases of $10,000 or more, except in emergencies?

8. Does the system of accounting provide for a periodical statement of assets and liabilities, or is it confined to a statement of receipts and expenditures?

9. Has any policy been established respecting purchases outside the United States in cases where lower prices can be obtained in foreign markets?

The Group upon Efficiency of Plant, including the Railroad, of which Elihu Thomson was chairman, decided to make special inquiries as to the following:

1. Number of dredges.
2. Number of excavators.
3. Accessories.
4. Number of railway cars.
5. Number of locomotives.
6. Track conditions.
7. Average length of haul.
8. Workshifts.
9. Improvements in machinery to be made.
10. Lighting in case of night work.
11. Proposed plant for electric power.

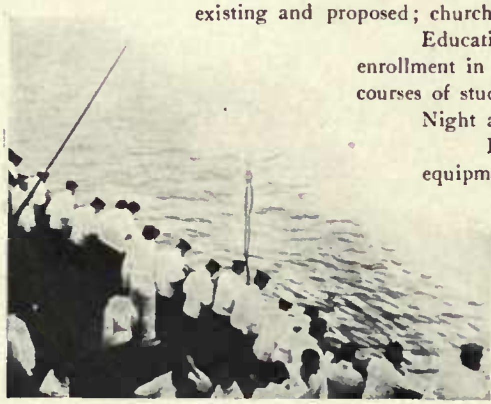
The group having Social and Racial Conditions, including Welfare and Ethical Questions to consider, organized with Mr. Maxwell, of Cincinnati, as chairman, and Mr. Taylor, of Cincinnati, as secretary. The subject was divided, and sub-committees were appointed as follows:

Religious and Moral Conditions: Messrs. Morron, Crawford and Hutchinson.—Buildings and equipment existing and proposed; church organizations; Y. M. C. A. etc. Saloons. High license. Social evil.

Educational Conditions: Messrs. Minot, Conover and Ault.—Buildings and equipment; enrollment in proportion to school age population. Segregation of races. Organization, grading and courses of study. Appointment, experience and origin of teachers. Federation. Languages taught. Night and adult schools. Compulsory attendance.

Recreations and Amusements: Messrs. Batcheller and Taylor.—Buildings and equipment. Theaters. Music. Dancing. Recreation and athletic grounds and organizations. Clubs. Secret societies. Gambling. Segregation of races.

Law and Order: Messrs. Maxwell, G. M. Wright and Campbell.—Code of Laws. Courts. Police. Private tenure of land. Conditions in Colon and Panama.



Stewards of the "PRINZ JOACHIM" observing the members of the Commercial Clubs going ashore at Colon.

The Group on Housing and Food, of which Mr. Burnett, of Boston, became chairman, when Mr. Knox grew too ill to give the subject further attention, included in its membership F. B. Carpenter, of Boston, who is commissary general of Massachusetts. Upon the question of food the group adopted the following lines of inquiry:

1. Who is in charge of the subsistence of employees?

HEADS OF DEPARTMENTS, ADMINISTRATION BUILDING, CULEBRA, CANAL ZONE
Left to right: Top Row—J. F. Stevens, Chief Engineer; H. D. Reed, Executive Secretary; W. G. Comber, Division Engineer, La Boca; E. P. Shannon, Secretary of Chief Engineer; W. G. Bierd, Manager Panama Railroad; Jackson Smith, Manager Labor Quarters; Captain Shanton, Chief of Police, Canal Zone. Second Row—J. G. Holcombe, Division Engineer, Municipal Engineer; Colonel Gorgas, Chief Sanitary Officer; Joseph Ripley, Assistant Chief Engineer; F. A. Maltby, Principal Assistant Engineer; W. G. Tubby, Material and Supplies. Bottom Row—E. J. Williams, Disbursing Officer; D. W. Bolich, Division Engineer, Culebra; R. Arango, Division Engineer Met. and River Hyn.; H. L. Stuntz, Local Auditor; G. D. Brooke, Superintendent Motive Power and Machinery; W. M. Belding, Master Builder.
(Average age, 43 years)

2. Is there any restriction as regards diet, or can any employee have what is desired?

3. Is the plan of army rations used, or is subsistence sold in quantities, irrespective of immediate needs?

4. Price lists of commissary stores.

5. Is there any regulation as regards the kind of food issued, or is this left entirely in charge of the purchaser?

6. How are stores paid for, in cash or in orders on the paymaster?

7. Are exchanges established similar to post exchanges at an army post, or do the commissary stores of the Commission carry a large variety of stores other than the usual army rations?

The Group upon Efficiency of Labor, of which Mr. Farwell, of Chicago, was chairman, agreed to seek information along these lines:

Different nationalities of labor.
Proportion of each nationality.
Relative efficiency of each nationality.
Proportion of each nationality in the hospitals.
How many days in the week does each nationality average to work?
How does the average American workman in Panama compare in efficiency with the same man in the United States?
Difficulty in getting labor.
The best sources of supply.
Admitting sufficient housing, how many men are there at work now, and how many more could be worked to advantage?
Also how many additional men will probably be wanted each year to produce the maximum results?
Is there any insufficiency of skilled labor?
Efficiency of foremen, and chances of promotion.
What difficulties are there in handling labor?
Is there any probability of strikes?

The result of this preparation for the visit was apparent within half an hour after the tug had landed the party on the wharf at Colon. A train was waiting. A committee to receive and to conduct personally was ready. For this duty, more onerous than they had imagined, "The Chief," as Mr. Stevens was universally called on the Isthmus, had selected Jackson Smith, Colonel W. C. Gorgas, W. D. Bolick, Arnold Shanklin and W. G. Bierd. Members of the party were not slow in learning that Jackson Smith was manager of labor, quarters and subsistence; that Mr. Bolick was one of the division engineers of the canal construction, and that Mr. Bierd was general manager of the Panama Railroad, whom "The Chief" accounted one of his most valuable discoveries in the make-up of the organization. Mr. Shanklin is the Consul-General to the Panama Republic, whose robust Americanism has made him a marked force in all Isthmian affairs. Everybody knew, without asking, Colonel Gorgas, who had given the Isthmus its first year in four hundred past without a single case of yellow fever. Each of these representatives of "The Chief" speedily found himself the center of a group of serious-faced, terse-speaking business men, who wasted no time in talk, but who asked questions right and left, who stopped to look into details, who talked with superintendents, with foremen, with clerks, with laborers.

On the Isthmus

THE nine-hundred and thirty-four miles of unbroken steaming from Porto Rico toward the Equator brought the "PRINZ JOACHIM" within view of the Isthmus early on the morning of Friday, March 1st. When the members of the Clubs in bath robes trooped up to the officers' deck to take their salt water plunges and showers behind the tarpaulin sided enclosure, they saw the low-lying mountains on the port side. It took some rubbering to adjust the points of the compass. Here was land in the wrong direction, and the sun was coming up in front of the ship. The Isthmian geography requires study. The sun rises in the Pacific and sets in the Atlantic, as seen from one point of observation. To cover the forty miles from the Atlantic to the Pacific one travels almost due south. There is two feet of tide in the ebb and flow of the Atlantic at Colon, and twenty-odd feet difference in the daily sea levels of the Pacific at Panama. The land lubber must be set right on several fundamental points like these before he is ready to study conditions in the Canal Zone.

Before going ashore by tug at Colon, the members of the Clubs familiarized themselves with advice from the Joint Committee to this effect:

No wandering in Colon, in view of the health rules.

Pack in suit cases, to be properly tagged, dinner dress suit, conveniences for spending the night at hotel, and clean linen.

Trip is dirty.

Wear high shoes.

American money is worth two for one. Take small change, which can be obtained from the purser.

Bargain with cabs. This is an individual expense.

As members are in eight groups, according to the subjects that interest them, it is suggested that groups keep together in landing, so as to meet the officials especially able to give them information desired.

A quick transfer from the dock to the special train was made. But before the train started one group was noting the brick-paved streets, the evidence that the low coral island which is the site of the Alantic terminus of the Canal has been raised out of the mire by filling as much as four feet.

Five minutes beyond the station at the docks the train halted. Mr. Bierd extended the opportunity to look over the railroad terminal yards, the machine shops and the round-house, to those who cared to go through them. He was a little surprised, probably, at the unanimity with which the members got out, and more so by the thoroughness with which Mr. Elihu Thomson's group entered upon the inspection. The railroad, as became impressive before the visit of the Commercial Clubs to Panama was finished, is the great mechanical factor in the building of the Canal. It is the chief of the tools. A mile of track is shifted or laid entirely new every day. Genius in railroad construction is building the Canal. It is saving millions of dollars in the moving of the tens of millions of cubic yards of dirt. Marvelous things men who are familiar with the evolution of railroad building in the States saw done during their brief stay on the Isthmus. They timed a long train of cars loaded high with rock and dirt and pushed out on a dump track. The cars were hardly at a standstill when a great scraper, drawn by a cable, was pulled from end to end, sweeping clean to one side of the track the entire train load. And then a car with a powerful apparatus somewhat like a snow plow, but stronger, moved along the same track, leveling and spreading and pushing out of the way the unloaded dirt. Six men with the equipment which has been adapted to canal construction—and there is great variety of it—do in a day what a few years ago would have taken three thousand men a week. This application of the most advanced mechanical appliances in railroad grading and construction, and the continuous exercise of trained ingenuity to create more mechanism of the same sort, filled the visitors with enthusiastic admiration and inspired confidence that the 52,000,000 cubic yards of dirt and rock to be taken out of the Culebra Cut, which is the heavy section of digging, will be moved. In January the amount taken out of the Cut was 566,750 cubic yards; in February, 650,000 cubic yards—a short month. By June it was expected that the removal would reach 1,000,000 cubic yards. The shifting of the tracks made necessary from day to day, as the dumps grow, and as the levels go down in the excavation, is largely a matter of mechanical appliances. Sections of track are picked up and shifted several feet by powerful machinery, which is wheeled on cars from point to point as needed.

With the mechanical devices performing such a vital part in the work, the railroad yards and shops came in for particular study by the group which observed the "Efficiency of the Plant."

The Isthmian Commission, realizing how much railroad experience must count in this canal building, has drawn upon the best talent that can be found, and, as well, has provided the latest devices and the best possible equipment. Jackson Smith and W. D. Bolick were associated in railroad building in South America. They had part in the construction of the wonderful road between Guayaquil and Quito in Ecuador, where it was necessary to lower a man by rope 150 feet and keep him suspended until he could drill a hole, put in a blast and thus secure a footing by which to locate one section of the route. Such men are not daunted by the magnitude of the Panama Canal. They go on devising methods to increase the amount of dirt handled, with the minimum of manual labor and the resultant economy, until they make—

The mountains to skip like rams, the little hills like lambs.

On the Isthmus there are two points of observation which overshadow the rest of the Canal route, interesting as is every one of the fifty miles from deep sea to deep sea. These points are "The Dam" and

"The Cut." In speaking of them the canal man does not say "The Gatun Dam" and "The Culebra Cut." He refers to "The Dam" and to "The Cut."

The Dam is to be built across the valley of the Chagres River just below the village of Gatun. It is five and one-half miles from the Colon terminus of the railroad, but seven and one-half miles from the deep water end of the Canal in the Atlantic, or the Caribbean. For the distance of four and one-half miles this end of the Canal is to be dredged through Limon Bay, the present water depth of the Bay varying from forty feet at the sea end to six feet just off the shore. This is a matter of dredging a channel and presents nothing of extraordinary interest. The members of the Clubs took a tug and went over this Atlantic end of the route, passing Cristobal, the point built out by the French. They saw the house that was constructed for and occupied by deLesseps, the group of shadowing palms, the little park and statue of Christopher Columbus presented by Eugenie in the days when hope of success ran high in France. The water of the Bay shoals into a marsh. Three miles of digging and dredging, through the marsh and lowland, brings this section of sea level canal to the locks and the Gatun Dam. It is not yet time to begin the monotonous but not difficult work of dredging this section. The Chagres is to be swallowed by the lake behind the Dam. As the Dam rises the dredging can go on. Much of the material pumped from the sea-level section may be disposed of in the Dam.

At Gatun the members of the Clubs left the train and devoted a considerable part of the first half day on the Isthmus to one of "the three big problems of the Canal," as President Roosevelt designated them.

If present plans are carried out, this dam at Gatun will extend from one high hill to another, across the valley of the Chagres. It will be 7,700 feet long. It will be one-half mile thick at the bottom, 550 feet wide at the crest. Behind this dam the water will back up nearly 85 feet deep; it will spread over the valleys and lower hills, until it covers considerably more than 100 square miles — some say as much as 200 square miles. The engineers' surveys indicate the formation of a great interior lake, thirty miles long, and in places eight miles wide. The territory covered, according to the engineers, will be not less than 118 square miles. It will be increased somewhat by the excessive rainfalls of the rainy season. It will swallow

Site of the Gatun Dam — A view across the valley on the line of the proposed embankment 7,700 feet long and one-half mile thick at the base.

A STEAM SHOVEL AT WORK

It lifts five buckets of spoil in two minutes, and loads ten cars in thirty minutes.

the Chagres River and its little tributaries. Rainfall in this valley of the Chagres means something new to visitors. Just before Colon was reached, the following prognostication was passed about on the decks of the "PRINZ JOACHIM."

> The moon governs the weather, as a rule,
> And I think the saying is true;
> For at Colon it rains when the moon's at the full,
> And it rains when the moon's at the new.
>
> When the moon's at the quarter, then down comes the rain;
> At the half it's no better I ween;
> When the moon's at three quarters, it's at it again,
> Besides it rains mostly between.

The members of the Commercial Clubs carried their rain coats two days and saw no use for them. Yet one day of the President's visit in November was made notable by a shower of over an inch in fifteen minutes. About five inches of rain fell in the twenty-four hours. But November and March represent the difference between the wet and the dry seasons. On the Atlantic side of the Isthmus the rainfall is 120 inches—ten feet—in the course of twelve months. The Chagres has been known to rise twenty-eight feet in a night. These figures enter into consideration of the lake and of the dam which confines it. To provide for any excess of water over the amount used in the locks—that is to maintain a steady level—a spillway is located at one end of the dam.

Approaching Gatun from the Atlantic, the ship will come to three locks, each 1,000 feet long and 100 feet wide. The ship will enter the first lock and be raised twenty-eight and one-third feet. The second lock will elevate twenty-eight and one-third feet, and the third lock will do the same. From the third lock the ship will ride out upon the lake eighty-five feet above the level of the Atlantic Ocean, and above that section of the Canal it has just left.

The members climbed the high hill which will be one end of the 7,700 feet of the dam, and viewed the location of the first lock in the descent, the excavation for which was in progress. They found the steam shovels busy and the dirt trains moving. The flight of three locks will be double. While one series of locks is in operation raising a ship to the lake, the duplicate set beside it may be lowering a ship from the lake to the sea level. These pairs of locks are to be built as one structure with a wall dividing them into two independent parts. The structure of one pair of these double locks will be 360 feet wide, of reinforced concrete, with outer walls fifty feet thick at the base and narrowing to about twelve feet at the top. The wall dividing the structure into double or duplicate locks will be sixty feet thick. The whole structure will be buried in earth, only the coping and the interior being exposed.

Principal Assistant Engineer Ripley, a graduate of engineering at the University of Michigan, with thirty years experience at the Sault Ste. Marie Canal between Lake Superior and Lake Huron, explained to the visitors that at the Sault the lift provides for a vessel 600 feet long, sixty feet wide, with a draft of twenty feet. Here the lift is one-third more than at "The Soo" and provision is made for larger craft. At each end of the upper lock are to be two pairs of gates for more perfect control of the water.

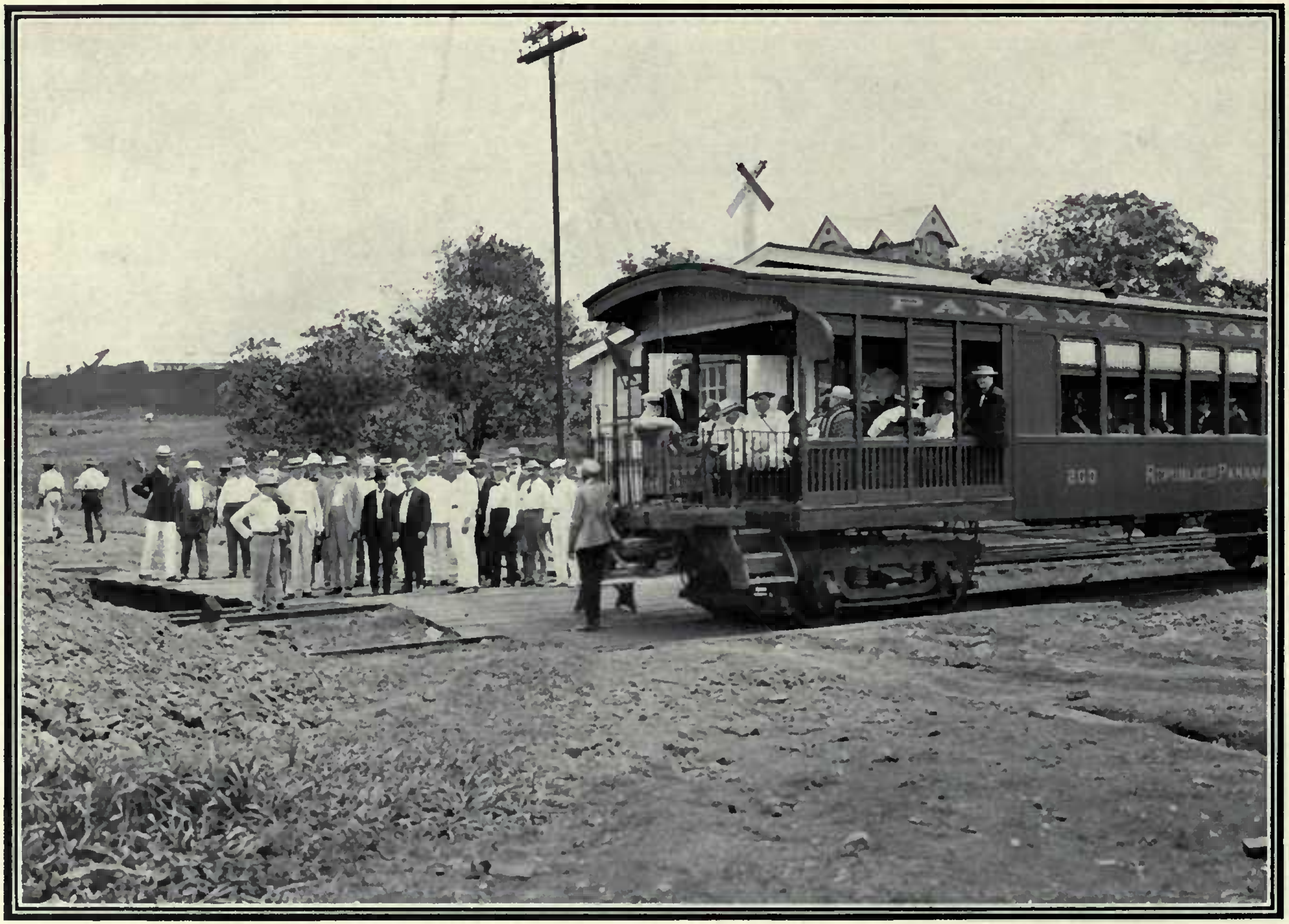
Valley of The Chagres — The old town of Gatun which will be obliterated by the Dam and Lake.

The visitors gave special attention to the foundations upon which must rest this mighty dam and these massive locks. They handled the dirt and rock, and speculated upon the character of the formations. They saw the results of the borings. The surface is a firm, hard, reddish clay about twenty feet thick. Underneath and to great depth is a soft blackish rock, little more than indurated clay.

"It is nothing else than the old bed of the ocean" was the way one of the engineers described this underlying formation. The locks will be sunk in this clay and soft rock. The great dam will rest upon this foundation most of its length. For distances aggregating considerably over 2,000 feet of the dam's length there are two deep depressions in the soft rock, one 1,800 feet, the other 900 feet long. These depressions are filled with clay and scud to a depth of 200 feet, beneath which is coarse sand and gravel. The engineers expressed no apprehension as to the character of the foundations, or as to the strength of the dam to hold the lake nearly 85 feet deep at the base of the dam. The crest of the dam will rise fifty feet above the lake level which is 85 feet above the sea level. There were some unsettled questions of minor character about the locks and the dam, the engineers said, to be taken up when the members of the Canal Commission next visited the work.

A great camp has come into existence upon the hills overlooking the Gatun Dam site. The railroad tracks have been laid along the sites of the locks and the moving of the dirt has begun. The building of these enormous locks will be a work of years. Preparation for the magnitude of the work at Gatun is impressive. The house building, the sanitary and water systems are on a scale to take care of a community of at least 5,000 people. When the preparations are sufficient it is the purpose to work in shifts day and night at this point.

Standing upon the hilltop the members of the Clubs looked down upon the little village of Gatun, which will have to be moved. The dam and lake will entirely cover its present site. To construct the dam will require 22,000,000 cubic yards of rock and dirt. That is nearly half of the amount to be moved out of the Culebra Cut at the other end of the lake. But the Culebra Cut spoil will not be brought to the dam. The shortest possible haul is the rule of Panama Canal construction. The engineers locate the dumps with a degree of care second only to the attention given to the plan of excavation. No inconsiderable part of the 22,000,000



ON GATUN DAM SITE

Reading from left to right: Those on car—Oscar L. Whitelaw, Thomas P. Egan, W. K. Bixby, J. D. Bascom, J. W. G. Cofran, Walker Hill, E. G. Cowdery, Charles W. Knapp, John Omwake, David R. Francis, Rolla Wells, Collins Thompson (Official Stenographer). Those on the ground—John W. Warrington, D. B. Meacham, H. C. Scott, Lawrence Minot, Cyrus H. McCormick, Benjamin Carpenter, B. W. Campbell, H. L. Laws, William Gerig (Engineer for Dam), Consul-General Shanklin, William E. Clow, W. G. Bierd (Gen. Mgr. Panama R. R.), E. S. Williams (Chief Dept. Finance), R. H. W. Dwight.

cubic yards which goes into the dam will be dredged from the sea-level canal below the dam and pumped to the place of deposit. When some one asked Engineer William Gerig if the engineers had no apprehension about the dam; if there was not danger of the water leaking through after the dam was finished, Mr. Gerig replied that there was as much danger of water working through the hills as through the dam. "We don't know what is inside of the hills," he said. "We will know what is inside of the dam. The dam will be just as solid and settled in its place as one of the hills."

At Gatun, acquaintance with the Chagres was formed. From this point the course of the river and the present route of the Panama Railroad parallel for some miles. The Chagres has an awful reputation in the rainy season, but when the members of the Commercial Clubs saw it the river was harmless looking. It reminded St. Louis members of the Meramec and Boston members of the Merrimac. The Chagres is a small river except when the rains in the mountains swell its volume. It is a succession of pools of clear blue water with frequent stretches of sandy gravelly beach. Along the bank is luxuriant vegetation save where the sanitary gangs have made clearings and burned the trees and brush. These gangs are working their way along the Canal Zone, cutting and burning as they go. "The jungle" line is being crowded back into the mountain valleys. This is changing the appearance of the Zone. It is making the conditions more healthful and at the same time preparing the way for the channel and for the dumps of spoil.

As the train left the site of the Gatun Dam and steamed up the valley of the Chagres, the engineers explained that where the rails ran there would be seventy-five feet of water when the lake is made. The depth of the lake decreases as the railroad grade ascends, but for more than twenty miles this Chagres Valley, which is the route of the railroad at present, will be under water. For a distance of ten miles from the dam the lake will be several miles wide, with the present hills forming islands of varying sizes. The depth will be sufficient for a much greater width of channel than the needs of the traffic demand. In other words, there will be a good deal of water to spare. When George M. Wright, of St. Louis, came on deck one morning during the passage through the Caribbean and looked all around the horizon without sighting a sail, he remarked to a man from Boston:

"There is a great waste of water here. At least 85% of it could be spared. We don't need it in our business."

For ten miles of the lake there will be water to spare. For sixteen miles of the twenty-three of lake travel in crossing the Isthmus the canal route will have a normal width of 1,000 feet,

A view of the deceptive Chagres River.

widening occasionally to considerably more than that, but not narrowing to less than the 1,000 feet. Beyond sixteen miles the width of the route narrows to 800 feet and maintains that for a distance of four miles. As the route, still by way of the lake, enters the more mountainous region, the width decreases. The lake ends. The Canal is in plain evidence with towering sides. This is the Culebra Cut, sharing with Gatun Dam the importance of the great problems involved. When the ships have climbed the three steps at Gatun and have sailed the twenty-three miles of the lake, they are more than half-way to the Pacific, but have only come to the backbone of the Isthmus—a backbone which is miles wide and which is made of something more substantial than the clay and shale at Gatun. In "The Cut" the drillers and the steam shovels are down to the trap rock. The explosives smash it but the spoil is heavy and the teeth on the steam shovels have to bite hard to hold it and raise it. A few days before the arrival of the members of the Commercial Clubs a blast of twenty-seven tons of explosive was let off at once in "The Cut". It tore into fragments 55,000 cubic yards of rock and soil. The engineers are now ready to do great things in the nine miles of Culebra Cut.

At Culebra the members of the Commercial Clubs met the Chief Engineer, John F. Stevens. From that hour until the departure at Colon Mr. Stevens gave much of his time to the visitors, accompanying them to various parts of the work, laying before them plans and detailed information. On the day before the arrival of the PRINZ JOACHIM the announcement of the resignation of Mr. Stevens had reached the Isthmus from Washington. It was a matter of surprise to the members of the Clubs who had received no intimation of the coming change before leaving the States. The party had hardly landed when the evidence that the change had come as a shock to the canal organization became apparent. Under such peculiar circumstances the observation of conditions and of the work was made, gaining, if possible, additional importance from the unexpected situation. Mr. Stevens set the example of entire frankness in his communication with the visitors, an example which was followed by all of his assistants and subordinate officials. Every question pertaining to the Canal that could be suggested was answered with perfect candor. Only upon the reasons which had prompted his resignation was the Chief Engineer reticent. His responses to the expressions of satisfaction from the members of the Clubs upon what they saw were gratefully appreciative. He showed emotion at the manifestations of loyalty by the organization. His manner was that of a strong man who had been under prolonged physical and mental strain, and who was looking forward to a rest as the first thing after relief. The explanations the Chief offered of the work showed that he was fully satisfied with what had been accomplished; that he believed the plan of preparation had been well laid. As for future progress, there was no mistaking the feeling of confidence he held that the Canal could be completed in eight years along the lines and upon the plans which had been developed. Mr. Stevens was quick and emphatic in his assurances to the members that no friction between the President and himself had prompted his letter of resignation. Mr. Stevens comes from old New England stock. His grandfather went into the wilds of Maine, made a home and reared a family. Earlier than that the family

AT LUNCHEON IN THE COMMISSION HOTEL CULEBRA

From left to right: At nearest tables—Frank J. Jones, Benj. Carpenter, Walter W. Taylor, D. B. Meacham, Daniel Catlin, W. J. Chalmers, Alfred L. Baker, Lawrence Maxwell, Jr., Frederick A. Gier, Dr. Henry S. Warren (Surgeon), Chas. Gordon Knox, Stephen L. Bartlett, R. H. W. Dwight, J. T. Carew, W. D. Mandell, J. G. Schmidlapp, H. W. Cumner, Chas. W. Knapp, Chas. W. Durrell, William Whitman, Robert M. Burnett.

tree had become rooted in various places in the Connecticut Valley. The Chief Engineer is a very quiet man. In the past year and a half he has drawn about him adventurous Americans, very few of whom had known him before coming to the Isthmus. Among these captains and lieutenants of the organization are "tropical tramps" as they call themselves — Americans to whom life and work in the tropics have a fascination. These are men who have built railroads in almost impossible regions. They found their way to the Isthmus when they felt there was something doing, and enlisted — that is the word — for the period of construction of the Canal. These men feel entirely at home under the conditions of the Canal Zone, and they make the young men who come down from the States feel at home with them. One of these "tropical tramps" who by sheer force of ability and devotion to the task, has been advanced to one of the highest positions on the work, was called upon for a speech at the reception given at the Tivoli by the members of the Clubs. Without fear of possible consequences deterring him, he bluntly declared:

"We will dig this Canal in eight years, gentlemen, if Washington will let us alone."

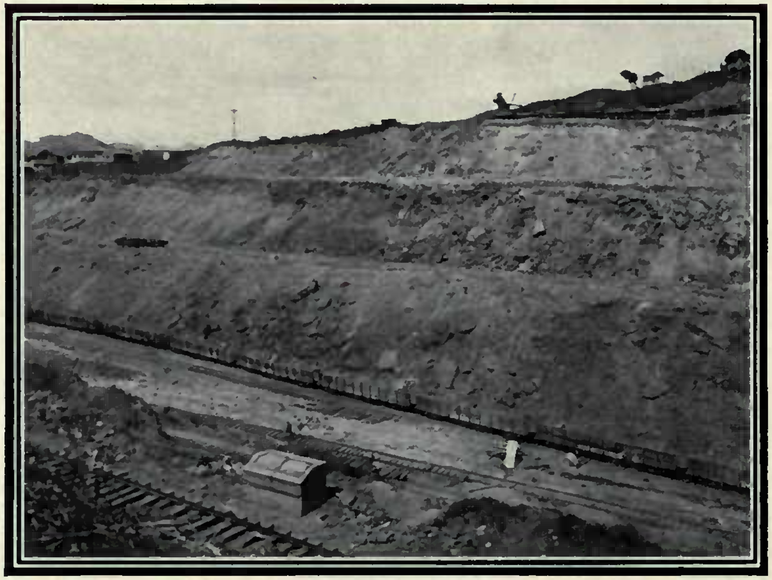
At Culebra the members of the Clubs took luncheon in a dining-room of the Isthmian Commission — one of those set apart for the clerical force. The dining-room is divided into two parts; in one it is allowable to sit without coats at the table; in the other, a little more formality is observed. The visitors, at their request, were served as nearly as practicable with the regular meal furnished at thirty cents to the official and clerical force of the Commission. The menu for luncheon, Friday, March 1st, 1907, was:

Cream of Oysters.
Columbia River Salmon, Sauce Hollandaise.
Pommes Naturelle.
Chicken Mayonnaise.
French Fried Potatoes.
Asparagus. Petits Pois.
Mince Pie. Fruit.
Cafe Noir.

From the porch of the hotel at Culebra the members of the Clubs in company with Mr. Stevens, and the Principal Assistant Engineer, Mr. Ripley, and the Division Engineer, Mr. Bolick, looked down upon the scene of activity in Culebra Cut. This is the real Canal — a narrow stretch between towering sides of rock and dirt. The slope is steep in places; in others, where the mountain range shows depressions, the incline is more gentle.

Culebra Cut means nine miles of digging. The digging goes down by benches or levels. A bench is the width and height that a steam shovel can scoop out as it moves along the bottom or the side of the cut. From the hotel where they had lunched the members of the Clubs could see miles of tracks on these benches, or levels, in the sides of the Canal. Steam shovels were at work one above another, so that excavation was in progress at the bottom and on every bench. Each shovel had its train of cars and engine beside it. With marvelous quickness the shovel took a huge bite out of the bank of dirt and rock in front, swung the bucket round to the side and dropped the contents out of the bottom. Four or five of the bites filled a car, which was pushed ahead to give place to another, and the filling was repeated. As soon as the train was loaded, away puffed the engine to the nearest dump; a scraper was drawn by cable from one end of the train to the other and the contents of the cars were swept to one side. Some of the cars were of different pattern and were tilted to throw off the contents. A club member noticed that here and there a steam shovel stood idle some time awaiting the delivery of empty cars. The Chief Engineer explained that the steam shovels had been sent down from the States more rapidly than the cars so that at that time he was working only about sixty per cent. of the capacity of the shovels. Of an order for 1,000 cars there have heen delivered 700; the remaining 300 should be on the Isthmus now and would be there but for a fire in the car building works which made it necessary to send the order to another plant. It was the fact that with the present equipment he moved 650,000 cubic yards in February, which gave Mr. Stevens confidence this amount could be increased to 1,000,000 tons a month as soon as the additional cars were received.

Culebra Cut — The benches or levels by which the excavation is widened. A steam shovel's furrow is forty feet wide.



Railroad tracks in the cut were as thick as in a railroad yard. Every bench or level held one or more tracks. As they looked down upon the moving trains, saw the puffing steam of the shovels and listened to the clatter and roar punctuated at frequent intervals by the boom of the blast, the visitors were prepared for some figures which Mr. Stevens obtained from his Division Engineer, in charge of the work in the Cut, Mr. Bolick. The statement which Mr. Bolick gave to the Chief in the presence of members of the Clubs showed that, as they looked on, there were working in the Culebra Cut: