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BIG JOBS ARE MANY ON CANAL

LOCKS, DAM AND CUT DESCRIBED

Paying Panama Bills Also Important—Sea Level Plan Tried and abandoned—Methods of Construction Marvels of Ingenuity

By GEORGE PALMER PUTNAM.

The "big jobs" on the Panama Canal, concerning which this letter is scheduled to deal, are many. The civil administration itself is a colossal and unique task, for the Canal Commission has an army of some 20,000 workers and their families, and dependents to govern, as well as the Canal Zone territory, which with its 448 square miles, makes a very fair sized state for any body to look after.

The chief engineering jobs that stand out as bigger and more fundamentally important, and are most picturesque, are the locks, the Gatun Dam and Culebra Cut. In addition there are lesser cuts, smaller dams, breakwaters, harbors, and a multitude of big jobs worthy of interest and admiration.

Of course the really biggest job of all, the planning and working out of the intricate details, was done years ago; at least, the greatest part of all that is an accomplishment of the past. Another all-important task is paying for the ditch; the American tax payers have done that, to the tune of about \$370,000,000. Still another "big job" is the sanitation of the Isthmus; that will be treated in the sixth Bulletin article. Sea Level Canal First.

When the French undertook to dig the canal back in the eighties, their first intention was to construct a sea level waterway. That is, their engineers thought they could put through a ditch from one ocean to the other at sea level, without the necessity of making locks. Before they finally quit, bankrupt, they had modified the plan and decided to use locks, for as the work progressed they found that the task of digging a ditch deep enough to pass on grade

through the hills of the Isthmus was enormously expensive and practically impossible.

When the United States took hold in 1904, there was some talk of making our enterprise sea level. This, however, was abandoned.

Six Double Locks.

There will be six double locks in the Canal, three lifts and three to lower vessels passing through, the maximum lift and lower being 85 feet. The fact that they are "double" means that each "step" is in duplicate, so to speak, so that vessels may go up and down through the same series simultaneously.

The lock chambers are 1000 feet long and 110 feet wide, with walls and floors of concrete, and massive mitering steel gates at each end. The side walls are 50 feet thick at the floor, thence narrowing upward, in steps, to an eight foot thickness at the 85 foot high top. The middle wall, which separates the two locks of the same flight, is 60 feet thick.

In the middle wall, and in the side walls and under the floors, are great culverts through which the water will be let into and drained from the lock chambers, as it is desired to raise or lower ships in them. A great saving in water is effected by transferring it from one lock in a flight to its mate; that is, when one lock is drained, and a vessel is to be raised in it to the higher level, the water which is being lowered in the adjoining chamber will be let into the empty chamber, thus using the same water for a double work.

Electricity Does Work.

The lock gates are seven feet thick and of steel and are 65 feet long and from 47 to 82 feet high. They weigh from 300 to 600 tons each, and will be operated with electric power generated by turbines from the waters of Gatun Lake.

As soon as a ship enters the lock approaches it will no longer use its own engines but will be taken charge of by four electric locomotives, which operate on tracks beside the lock walls. These tow it into position and into and from the chambers, two acting as tows and two as brakes to hold back as occasion demands.

A hint of the enormity of the three double locks at Gatun is contained in the fact that approximately 4,200,000 cubic yards of concrete, requiring about the same number of barrels of cement, will be used in that construction alone.

Gatun Dam Huge.

The extent of the great Gatun Dam and its importance in the Canal plan, were touched upon in the last article.

The dam, the reader will remember, is about 1 1/2 miles long, and impounds a lake over which steamers will travel for some 30 miles on their trans-Isthmian trip, at a level

55 feet above each ocean.

There is nothing striking about the dam but its great size. It has no peculiar engineering features, but is simply a huge hill into which some 20,000,000 cubic yards of material will have been dumped by the time it is completed, next year.

The way they build the dam is simple. At its base it is about half a mile wide. On each edge "toes" of rock were dumped, making heavy sustaining walls, so to speak, which gradually slope inward toward the center as they were built upward. Between these walls was pumped mud by suction dredges.

Deepest Ditch in World.

Of all the features of the Canal, Culebra Cut is probably the most impressive.

The Culebra Cut is the ditch which is being dug through the continental divide, and is longer and deeper than any ditch that ever has been dug. It is approximately nine miles long, and for several miles has an average depth of more than 280 feet, while a maximum depth of 320 feet is reached in several places. The amount of material that is to be excavated from Culebra Cut totals about 185,000,000 cubic yards.

Previous to the advent of the Americans the French company had done a lot of excavating, about 29,000,000 yards of which has proved useful to us.

Digging the Cut has been chiefly a matter of persistency. The biggest problem has been to transport the dirt and rock from the steam shovels to dumping places. John F. Stevens made his most important mark at Panama by solving this problem, which was essentially a railroader's work. Today there are more than 200 miles of track in the Cut, upon which dirt trains operate continuously, hustling long strings of loaded flat cars from the shovels out of the Cut at each end.

Much of the material has gone into Gatun Dam, 25 miles away, and much into the breakwaters on the Pacific side, some dozen miles distant.

Devices are Clever.

Now, however, the majority of the "spoils," as they call the excavated material, is simply used for general fills of swamps and low lands.

A clever device that saves much labor in the unloading of the flat cars is an automatic shovel which is pulled by a cable the length of the train of "flats," spilling from them all the dirt as it is drawn up to the engine by a spool. It is estimated that on each train four hours time is saved over hand labor and about \$50.

Instead of shifting track by hand there is a mechanical track shifter, which picks the construction track up bodily and swings it, ties and all,

to the desired position. This, of course, is chiefly on big fills, where the dirt is being constantly worked to one side.

In connection with the excavation in the Cut it is characteristic of the general efficiency to note that every loaded car runs down hill; all cars on the Pacific side of the grade divide go toward the Pacific, and all on the Atlantic side toward the Atlantic.

Canal Army Next Week.

But the most interesting feature of the Canal is not the construction work, but the workers. In next week's Bulletin the life of the "men on the job" will be described.

High Quality Tea.

A verdict in favor of high quality tea as a harmless drink is given by the London Lancet. It is pointed out that when caffeine and tannin are in a state of combination the harmful astringent qualities of the tannin disappear and the bitter taste of free caffeine is not perceptible. Teas of high quality yield, as a rule, a simple infusion of caffeine tannate, not of caffeine or of tannin, and such teas must be regarded as the most desirable from a physiological point of view. Excessive infusion, it is stated, will spoil a good tea, but even a short infusion of a bad tea may be as objectionable as an excessive infusion of good tea. On physiological grounds, therefore, the consumer of high quality teas runs less risk of digestive disturbances provided the tea is made properly.

Ancient Guidebooks.

Guidebooks for the use of pilgrims to Rome, known to exist in a rudimentary form since the time of Charlemagne, took a definite and characteristic shape in the twelfth century with the "Descriptio Fioraria Totius Urbis" and with the "Graphia Aurea" of the thirteenth. The institution of the jubilee in the year 1300, calling to Rome hundreds of thousands of wayfarers, opened a new market for descriptive literature on the Holy City, and new editions "De Mirabilibus" were produced at least four times each century.—London Atheneum.

A Comparison.

"That was a tempestuous outburst of oratory our friend indulged in," said one statesman.

"Tempestuous" is the word," replied the other. "Whenever he makes a speech it makes me think of a cyclone that has somehow learned to articulate."—Washington Star.

His Engaging Remark.

Mr. Dumbhead—Nelson was coming to call, but I told him you would be engaged this evening—
Miss Olemade (rapturously)—Oh, William!—Princeton Tiger.

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