THE PANAMA CANAL

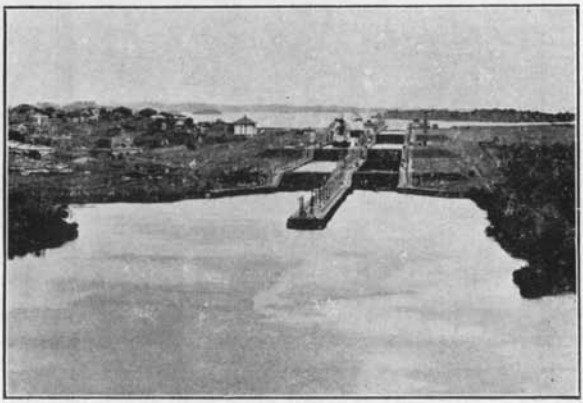
A NATIONAL ACHIEVEMENT IN A CENTURY OF PROGRESS

CONDENSED INFORMATION

CHICAGO WORLD'S FAIR, 1933

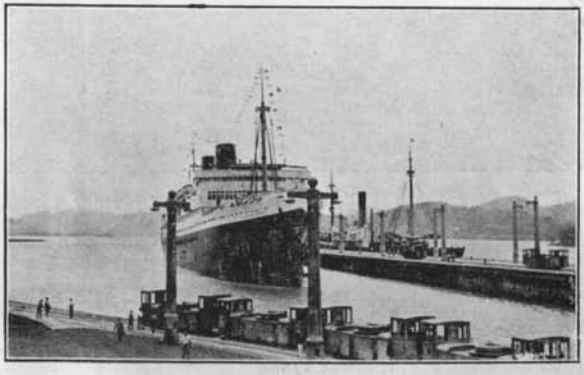
CONSTRUCTION

Situation.—The Panama Canal connects the Atlantic and Pacific oceans through the narrow Isthmus of Panama, at approximately 9° north latitude and 79° west longitude, where



The three steps of Gatun Locks.

also the long Continental Divide, extending from Alaska to Magellan, dips to one of its lowest points. In ancient geologic periods there was a natural channel here, but later the land rose and left the Isthmus as a barrier between the oceans. After



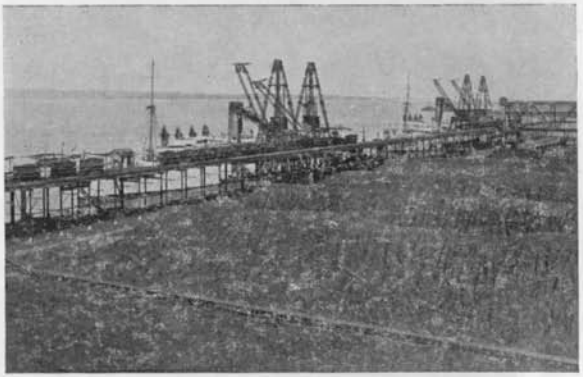
Liner beginning downward lockage.

centuries of erosion, with the formation of valleys on either side of the central ridge, the distance between shores at the place selected for the Canal was 34 miles. The lowest point on the Continental Divide was about 276 feet above sea level. The route of the Canal, however, passed half a mile to the east of this point, the center line crossing the Divide at 312 feet above sea level. The lowest point in the saddle between Gold and Contractors Hills was 305 feet above sea level. The height of Gold Hill is 662 feet, that of Contractors Hill 410 feet.

Electric locomotives, towing vessel in lock chamber.

Route of Canal.—The line of the Canal goes up the valley of the Chagres River on the Atlantic slope, passes through the ridge of the Continental Divide in the Gaillard Cut, and descends to the Pacific down the valley of the Rio Grande.

Following this route the Canal is 40.27 statute miles in length from shore line to shore line, and 50.72 miles from deep water to deep water. The air-line distance from end to end of the Canal is 43.05 miles. The Atlantic entrance to the Canal is



Stock pile and bunkering wharf, Cristobal Coaling Plant.

33.52 statute miles north of and 27.02 miles west of the Pacific entrance. Passage of a ship through the Canal requires about 8 hours.

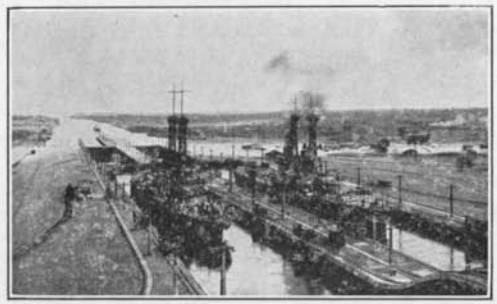
Direction.—Where the Canal is, the axis of the Isthmus runs from southwest to northeast. The Canal was built from northwest to southeast, almost at right angles to the strip of land, and the Pacific end of it is about 27 miles east of the Atlantic end.

Lakes and locks.—By building Gatun Dam across the valley of the Chagres, Gatun Lake was formed. It floods a great part of the valley and backs up against the Continental Divide. Its surface is 85 feet above the level of the sea, at normal elevation, which made it possible to reduce by 85 feet the depth of the cutting necessary to make the channel between Gatun and Pedro Miguel, a distance of $31\frac{3}{4}$ miles.

The passage between the Atlantic Ocean and Gatun Lake is made by the 3 steps at Gatun Locks. On the Pacific side the passage between the summit level (Gatun Lake level) and the Pacific is made by means of Pedro Miguel Lock, Miraflores Lake, and Miraflores Locks. A set of 3 locks, to make the whole step at one time, would have been built on the Pacific side if it had been practicable to secure a site affording a firm rock foundation large enough to accommodate it.

Gatun Dam.—Gatun Dam is a long, low, broad ridge built across the valley of the Chagres where is passed through a gap, about 7 miles above the mouth of the river. It was built in 2 wings, extending from either side to an intermediate hill which rose near the center of the swampy stretch across the valley. The hill, being rock, was taken as the foundation for the concrete spillway. In building each wing, parallel ridges or "toes" of rock were dumped about a half a mile apart, and the space between the ridges was filled with an impervious mixture of clay and sand. As the height increased the dumping of rock was carried inward, bringing the toes closer together; and gradually an artificial ridge was formed. The total amount of fill placed was approximately 23,000,000 cubic yards.

As completed, the two wings of Gatun Dam and the spillway have an aggregate length of 8,400 feet. Gatun Dam is nearly half a mile wide at the base, sloping gently to a width of 100 feet at the top. The top of the dam is 105 feet above sea level or 20 feet above the normal surface of the lake. The surface of the dam has been planted with grass and shrubbery and the two wings are the site of an 18-hole golf course.



Battleships in middle chambers of Gatun Locks.

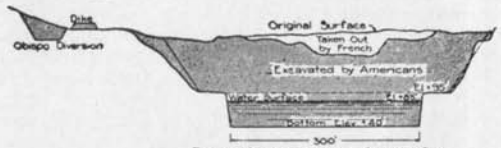
Spillway.—To control the rise of the lake, Gatun Dam is provided with a spillway, through which excess water in the lake is wasted, flowing into the Atlantic through the old channel of the Chagres. The spillway dam, a structure of concrete, on which the 14 regulating gates are mounted, was built in the form of an arc of a circle and is 808 feet in length. The spillway discharge channel is 285 feet wide.

Gatun Lake.—Gatun Lake has an area of 163.38 square miles with shore line of 1,100 miles, when its surface is at its normal elevation of 85 feet above sea level. It is the largest artificially formed lake in the world. The area of the watershed tributary to the lake is 1,320 square miles. The quantity

of water in the lake at normal level is 183,136 million cubic feet, or 4,204,000 acre-feet.

Sections.—The Canal between the Atlantic Ocean and Gatun Locks and the Pacific and Miraflores Locks is at sea level. The Atlantic sea-level section is about 6 2/3 miles long. The length of channel within Gatun Lake from Gatun Locks to the north or Atlantic end of Gaillard (Culebra) Cut is 23¾ miles. The Cut is 8 miles long, extending from Gamboa to Pedro Miguel. The length of the channel through Miraflores Lake is a mile, and that of the Pacific sea-level section is 8 miles.

Gatun Locks, including the approach walls, are 1 1/5 miles long; Pedro Miguel Lock, 5/6 of a mile; Miraflores Locks, slightly over 1 mile. Each of the twin chambers in every flight of locks has a usuable length of 1,000 feet, and width of 110 feet and is about 70 feet deep. The Miraflores Locks have extra depth on account of the tidal variations in the Pacific. The flights are duplicate or "double-barreled" and ships may be passed in opposite directions simultaneously.

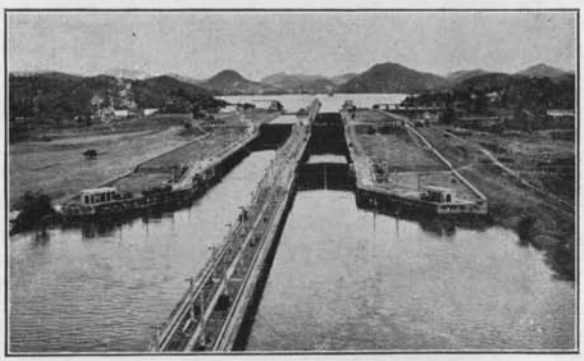


Typical Cross Section of Culebra Cut
Bas Obispo to Pedro Miguel

Madden Dam.—To supplement the water supply of Gatun Lake a reservoir is to be formed by building a dam across the Chagres River at Alhajuela, above the level of Gatun Lake. An 18-foot road extends from Summit to Alhajuela. A private company is building the dam under contract. The new reservoir will contain about 22 billion cubic feet of water and increase by about 3/5 the present dry season storage, thus increasing the year-around capacity of the Canal.

HISTORY

Construction.—The first actual work on the Canal was begun by the French on January 20, 1882, in excavation of Culebra Cut. This company operated until 1889. A reorganized company resumed operations in October, 1894, and continued work


Miraflores Locks, Miraflores Lake in background.

of varying extent until its rights and property were purchased by the United States under the authority of the Act of Congress of June 28, 1902. The American occupation of the Canal

Zone began on May 4, 1904, and in the eleventh year after that the Canal was opened. The first ocean steamer passed through on August 3, 1914, and on August 15, 1914, the Canal was opened to commerce. The official and formal opening of the Canal was proclaimed by the President on July 12, 1920.

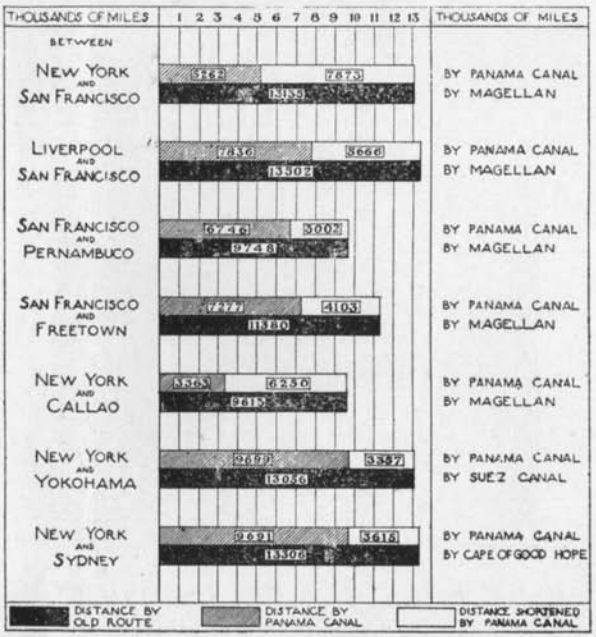
DISTANCES SAVED

The reason for the Canal is the reduction it effects in distances at sea. The following are representative savings of distances through its use:

From New York.—Between New York and San Francisco the distance of 13,135 nautical miles by way of the Strait of Magellan has been reduced to 5,262 miles by the Canal; the saving is 7,873 miles, or three-fifths. From New York to Valparaiso the reduction by use of the Canal is 3,747 miles; to Callao, 6,250 miles, to Guayaquil, 7,405 miles; to Wellington, N. Z., 2,822 miles; to Yokohama, 3,357 miles.

From Liverpool.—From Liverpool to San Francisco the distance by way of the Strait of Magellan, 13,502 miles, has been reduced to 7,836 miles by the Canal, a saving of 5,666 miles. The distance saved on the voyage to Valparaiso is 1,540 miles; to Callao, 4,043 miles; to Honolulu, 4,403 miles; to Wellington, N. Z., 1,366 miles.

The chart below illustrates graphically some of the reductions of distances by the use of the Canal.



TRAFFIC TO JANUARY 1, 1933

To January 1, 1933, tolls-paying traffic through the Canal had aggregated 71,672 vessels, 326,679,554 Panama Canal net tons; tolls paid amounted to $302,626,256.51; and cargo carried amounted to 329,562,164 long tons. For the five years ended June 30, 1932, such traffic averaged 5,818 vessels, $25,300,320.06 tolls, 27,042,949 tons of cargo per year. In

these 5 years ships of 27 nationalities passed through the Canal; American ships were about 44 per cent of the total, British about 26 per cent. About 34 per cent of the cargo was in the United States intercoastal trade.

United States Government and other nontoll-paying vessels.—In addition to the commercial traffic noted above, to January 1, 1933, there had been 6,748 transits of vessels passing through the Canal without payment of tolls, exclusive of craft in the service of the Canal. These were principally United States Government vessels, but also include vessels owned by the Governments of Panama and Colombia, and vessels transiting the Canal solely for the purpose of dry-docking and undergoing repairs at Balboa shops.

Total transits through the Canal other than Canal floating equipment, numbered 78,420 to January 1, 1933.

COMMERCIAL AND FINANCIAL STATISTICS

Rates.—Tolls are levied on the net tonnage of the ships, which is the interior spaces which can be devoted to the carriage of cargo or passengers. The rate for laden ships is $1.20 per net ton, Panama Canal measurement, and the rate for ships in ballast, 72 cents per net ton; with the proviso that the amount collectable shall not exceed the equivalent of $1.25 per net ton as determined under the rules for registry in the United States, or be less than 75 cents per net ton on the same basis. Each "net ton" is 100 cubic feet or 2.83 cubic meters.

Construction cost, net revenues, and capital interest.—While the Panama Canal was opened for traffic in August, 1914, its early years of operation were hampered by slides, and commercial traffic did not reach normal development until after the close of the war era. For these reasons the end of the fiscal year 1921 was fixed upon as the date that the Canal would be considered as completed, and the cost of the Canal has been calcu-

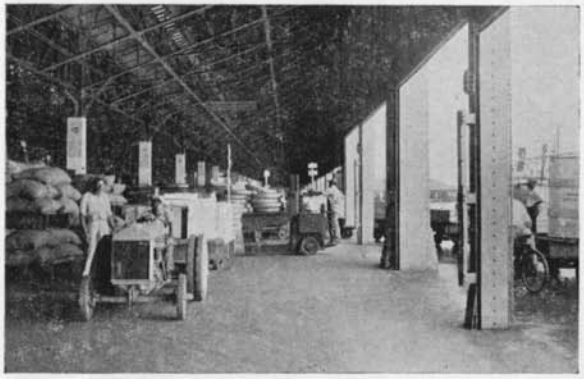
Steamer in Gaillard Cut, near Gold Hill.

lated as of the date, June 30, 1921. Accountants from the Bureau of Efficiency have fixed the capital cost of the Canal as of the date stated, based on 3 per cent interest, compounded annually, at $525,812,661; and there has been expended since 1921 for capital improvements $7,293,348; giving for the total capital investment on June 30, 1932, $533,106,009. The interest which must be charged against operations for the fiscal year 1933 therefore amounts to $15,993,180.27.

The greatest amount of tolls earned in any one month was $2,502,815.12, in January, 1929. The average commercial ship pays approximately $4,500 in tolls for transit.

Cost of tolls per ton of cargo.—Tolls are not levied on the nature of the cargo carried, but on the capacity of the ship. The cost per ton of cargo for sending a ship through the Canal varies, accordingly, with the nature of the ship and the quantity carried; the lowest cost per ton has been 21.03 cents, on a cargo carrier heavily laden with iron ore, and from this figure it ranges upward. The average for bulk cargoes is approximately 65 cents per ton of 2,240 pounds.

Saving 3 2/3 to 6 days at sea pays tolls.—If the cost of operating a ship be taken at 20 cents per net ton a day (and this, of course, varies greatly as among ships, depending on the vessel and the route over which she is operating), the cost of the



Cargo-handling on one of the steel and concrete piers at Cristobal.

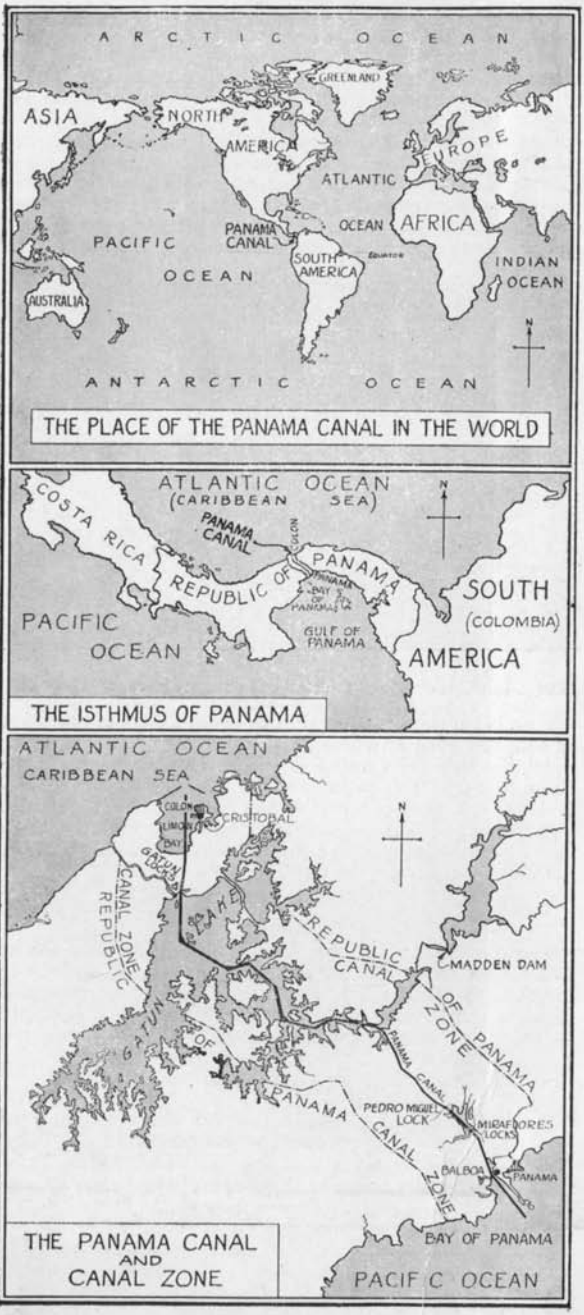
tolls on laden ships is equivalent to about 6 days of operation at sea. On such an assumption, other considerations being equal, if a ship saves over 6 days in her voyage by using the Canal it is profitable to come this way. Translated into distance, a 10-knot ship, traveling 240 nautical miles a day, will gain by using the Canal if it shortens the distance by 1,440 miles. On the ame basis, a ship in ballast can profit by using the Canal if it saves 3 2/3 days.

FACILITIES FOR SHIPPING

The completed Canal has been equipped not only for its own satisfactory operation but for assistance and supply to the ships traveling this way. It is an outpost of repair and supply in a section of the world otherwise not well equipped for the maintenance of modern vessels.

ORGANIZATION

Establishment.—The organization for the operation and maintenance of the Canal and the government of the Canal Zone, as at present constituted, was established by the President in conformity with the provisions of the Panama Canal Act of August 24, 1912. Authority is vested in a Governor as head of the organization known as The Panama Canal. The Governor is also President of the Panama Railroad. The Panama Canal is an independent establishment in the Government service, directly under the President; but as a matter of executive arrangement, the Secretary of War represents the President in the administration of Canal affairs.



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