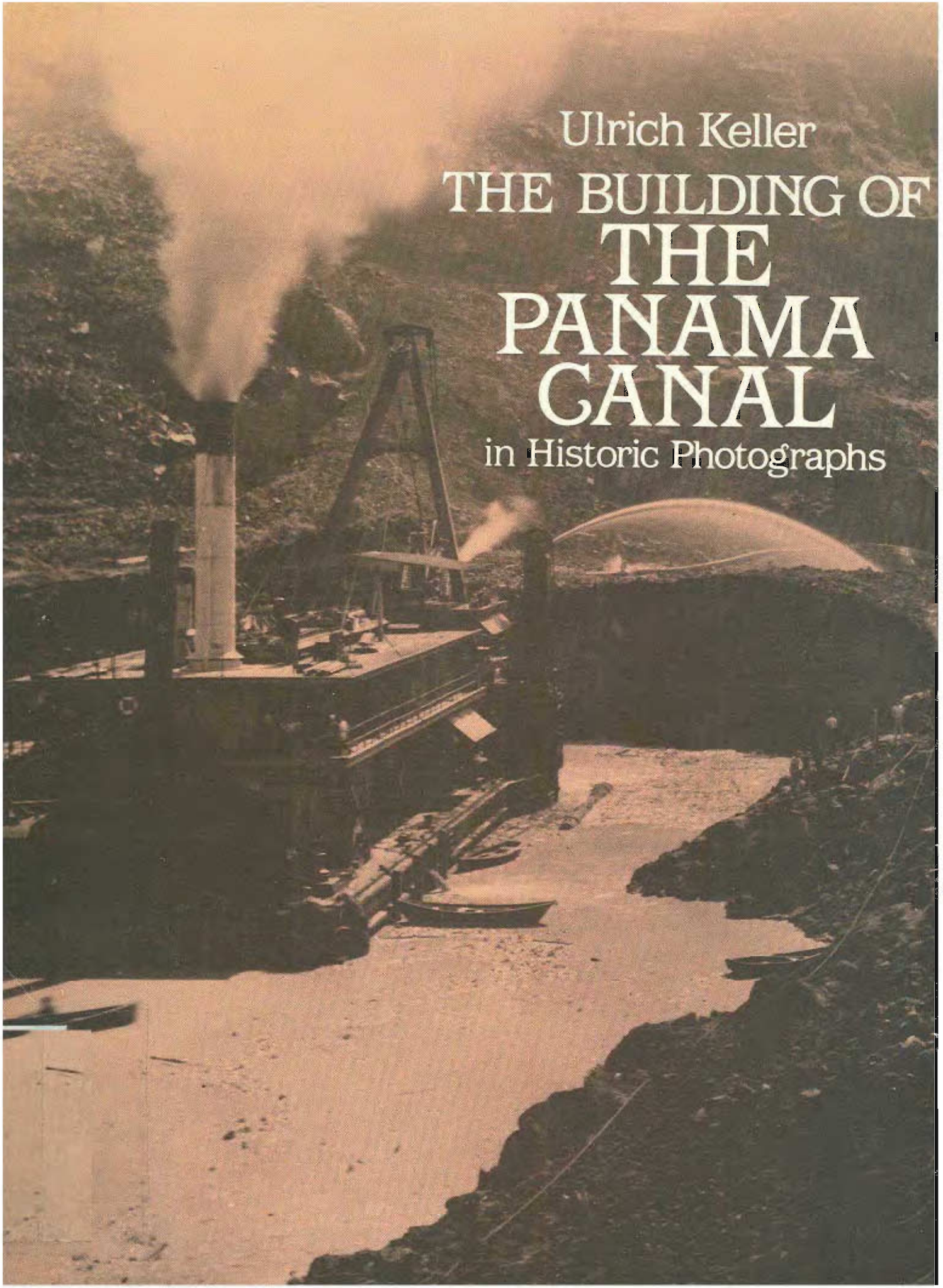

Ulrich Keller

THE BUILDING OF THE PANAMA CANAL

in Historic Photographs

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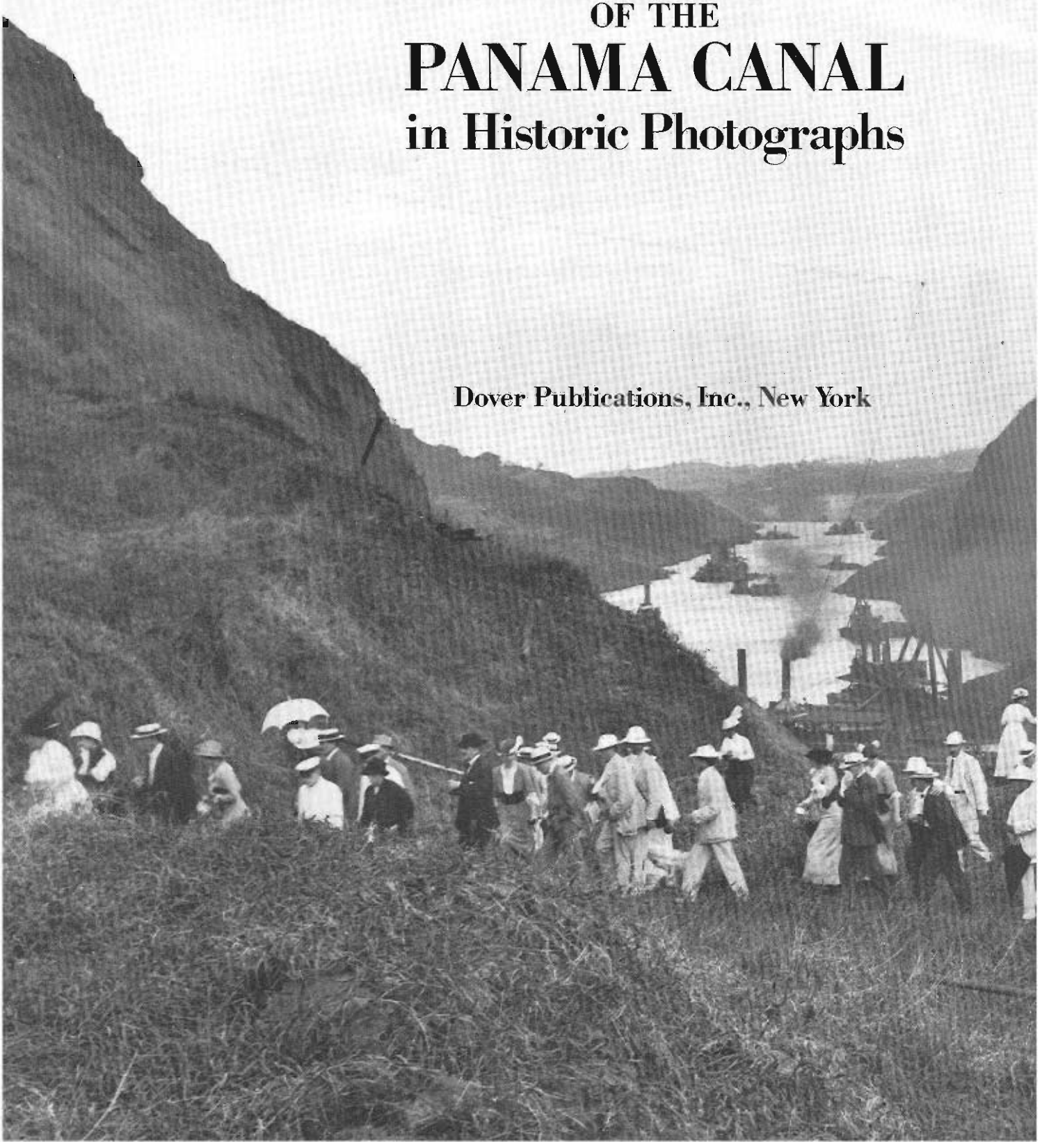

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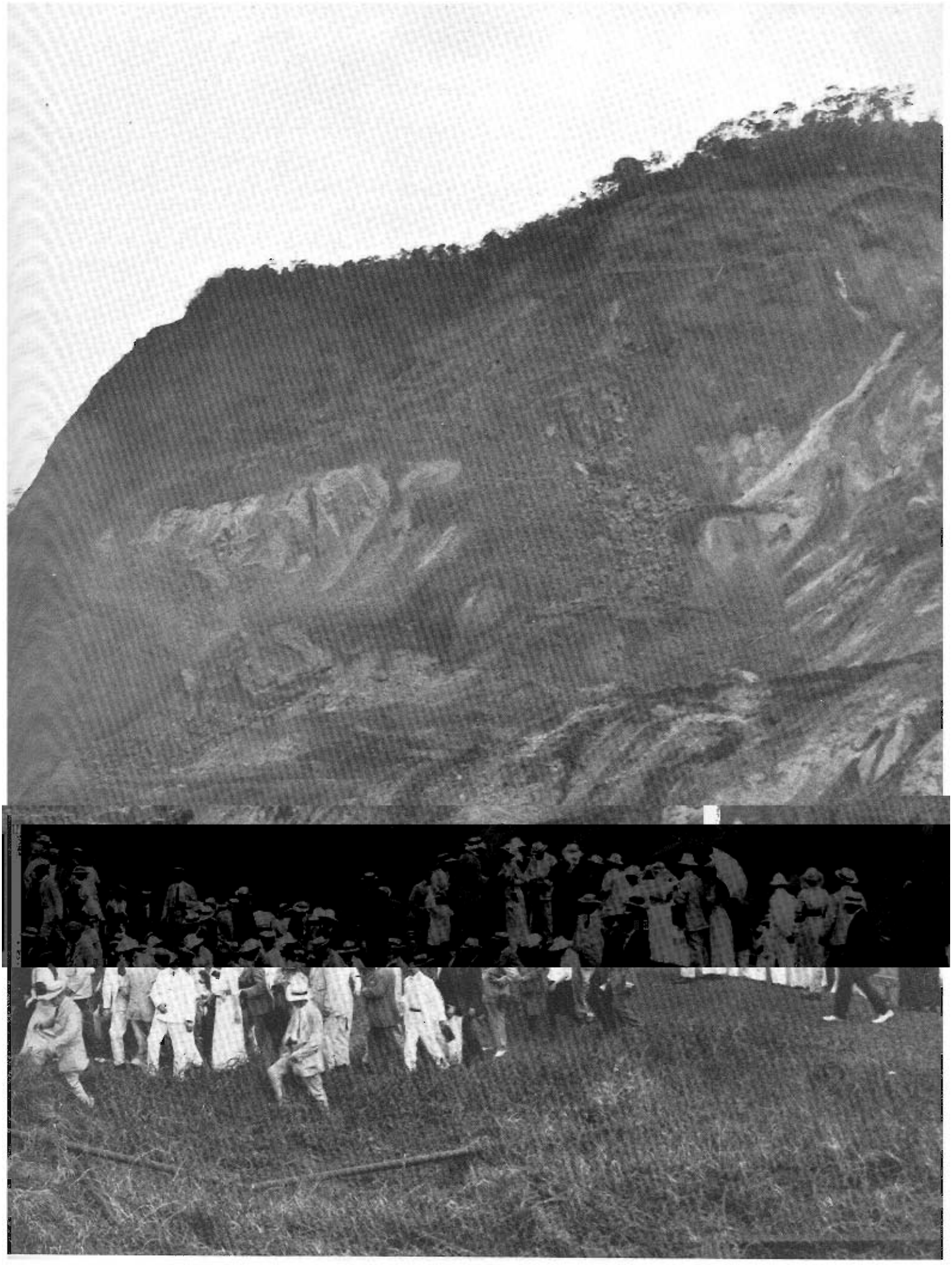


Published in Canada by General Publishing Company, Ltd., 30 Lesmill Road, Don Mills, Toronto, Ontario.
Published in the United Kingdom by Constable and Company, Ltd., 10 Orange Street, London WC2H 7EG.

The Building of the Panama Canal in Historic Photographs is a new work, first published by Dover Publications, Inc., in 1983.

Book design by Barbara Effron

Manufactured in the United States of America
Dover Publications, Inc., 180 Varick Street, New York, N.Y. 10014

Library of Congress Cataloging in Publication Data
Main entry under title:

The Building of the Panama Canal in historic photographs.

1. Panama Canal (Panama)—History—Pictorial works.
I. Keller, Ulrich, fl. 1977– .
TC774.B86 1983 627'.137'0972875 82-9543
ISBN 0-486-24408-3 (pbk.)

Introduction

Ever since 1513, when Balboa discovered the Pacific behind the narrow land bridge connecting the continents of North and South America, men dreamed of building a canal to join the two oceans.[1] Holy Roman Emperor Charles V entertained the idea quite seriously, and ordered a land survey in the Panama region to explore the feasibility of an artificial waterway. But it was determined that the difficulties of the project far exceeded the technical resources of the time. Moreover, the piercing of the Isthmus appeared to many contemporaries as such a bold, if not blasphemous, proposition that a Jesuit scholar felt compelled to utter the warning:

> I believe there is no humaine power able to beate and breake downe those strong and impenetrable Mountains, which God hath placed betwixt the two Seas, and hath made them most hard Rockes, to withstand the furie of two Seas. And although it were possible to men, yet in my opinion they should fear punishment from heaven, in seeking to correct the workes, which the Creator by his great providence hath ordained and disposed in the framing of this universall world.[2]

Considerations of this nature put the canal question to rest for two hundred years. Only in the nineteenth century, the age of scientific and industrial progress, did the spirit of enterprise begin to outweigh the fear of God and the menace of physical obstacles. Beginning with Alexander von Humboldt, various explorers toured the Isthmus, searching for an ideal canal location and making a variety of proposals.

The man who finally chose Panama as the most appropriate site and tackled the enormous financial and technical problems involved in an enterprise of such magnitude seemed to be predestined for the job. Ferdinand de Lesseps had done the impossible before—he had completed the celebrated Suez Canal in 1869—and he declared that the mountains of Panama represented a less formidable foe than the Egyptian desert. He even insisted on the practicability of a sea-level canal as opposed to a more modest lock canal.

Thanks to his reputation (and to enormous bribes paid to bankers, politicians and newspapers), Lesseps was able to raise an initial capital of 300 million francs ($60 million). In January 1881, an advance party of French engineers arrived on the Isthmus, followed by an ever-increasing stream of workers and machinery. By May 1884, the labor force had swollen to a total of 19,000 men. But progress was much slower than expected. As it turned out, Lesseps' assessment of the geographical conditions and the technical as well as financial means necessary to overcome them had been grossly inadequate. The mountain range at Culebra required a much greater volume of excavation than the original plans called for, the technical plant was too light for the task at hand, a bewildering and unmanageable diversity of machinery had been brought in and the employment of over two hundred individual contractors created additional confusion, not to mention skyrocketing costs.

But the most severe and eventually crippling problem was caused by the ravages of yellow fever, typhoid fever and malaria. Enormous sums were spent on hospital facilities which were praised as the finest of their time but provided little relief since the causes of the diseases and effective cures remained elusive. As a result, about 22,000 workers died on the job, making it increasingly difficult to recruit volunteers for canal construction. It must be emphasized, though, that contemporary observers were unanimous in their admiration for those Frenchmen who did go to Panama and stuck to their deadly jobs with a courage comparable to that of soldiers in battle.

Combined into one confusing knot, the medical, technical and financial problems became insurmountable for Lesseps, whose Compagnie Universelle du Canal Interocéanique declared bankruptcy in 1889. One and a half billion francs had been expended and 70 million cubic yards had been excavated, but in the end 800,000 shareholders, mostly from the low- and middle-income range, lost every franc of their investment. It was the biggest financial fiasco of the nineteenth century. Revelations about the astronomical bribes and kickbacks involved added a great deal of legitimate bitterness to the ensuing public debate.

In 1894, a new French canal company was founded with a very modest capital stock of 65 million francs. The company resumed construction on a small scale, primarily trying to maintain the building concession that had been granted to Lesseps by the Colombian government, in whose territory the route of the canal was situated. It was obvious, though, that the French were in no position to complete the project. A bigger economic power was needed to launch a fresh attempt where the French had run aground.

The only major question to be resolved was the set of conditions under which the building concession would change hands. In this respect, the American government was in an enviable position. Clearly, the French canal company desired nothing more than to sell its Panamanian assets and to pull out of a hopeless situation. By the same token, it appeared likely that the Colombian government would be accommodating because a very real possibility existed that the Americans would choose an alternative canal site in Nicaragua. In fact, the feasibility of a Nicaraguan waterway had been studied in detail and an American stock company had made an abortive attempt to begin construction there, losing $6 million in the process. More than that, in January 1902, the House of Representatives had authorized President Theodore Roosevelt to build a Nicaraguan canal at a cost of $180 million, of which $10 million were available for immediate expenditure. Later that year, both houses passed a bill appropriating $135 million for the acquisi-

Fig. A. John F. Stevens.

tion and continuation of the Panamanian canal project, but Roosevelt was free to revert to the alternative site should he be unable to obtain favorable conditions from the French and Colombians.

In the following months, a quick agreement was reached with the French canal company, but Colombia was dissatisfied with the less-than-generous American proposal, which offered a down payment of $10 million combined with an annual "rental fee" of $250,000 for a six-mile-wide strip of land across the Isthmus. After unsuccessful Colombian attempts to raise the price of the concession, the American offer was turned down in August 1903.

One might expect that this was a good reason for the Roosevelt administration to revive the Nicaraguan option, but the man who loved to speak softly while carrying a big stick saw still another possibility. There were a number of politicians and businessmen in the city of Panama who could only gain by setting up an independent Panamanian state and who were indeed willing to stage a "revolution"—provided the Americans offered tacit support. Roosevelt made sure of one. Several American ships were stationed near the Isthmus "in the event of any disorder there," troops were landed to "protect life and property,"[3] and the officials of the American-controlled Isthmian Railroad received instructions on whom to transport and whom not to transport. Due to these inconspicuous arrangements, the Republic of Panama successfully seceded from Colombia on November 4, 1903. Of course, Roosevelt never admitted that it had been a phony revolution, but 18 years later Colombia received an indemnity of $25 million from the Harding administration, a conciliatory gesture implying that the events of 1903 had taken a somewhat improper course.

Naturally, the new government of Panama was an even weaker negotiating partner than Colombia. Only two weeks after the "revolution" a treaty was signed which granted the United States greater advantages for the same price than had been provided in the earlier, rejected document. Among other things, the width of the canal corridor was increased from six to ten miles and the American authority in this area was upgraded to de facto sovereignty.

With all political problems cleared one way or another, the second, American canal adventure was ready to be launched. An Isthmian Canal Commission assumed authority over Canal Zone affairs and Chief Engineer J. F. Wallace was put in charge of construction. On May 4, 1904, the French property on the Isthmus was formally transferred to the Americans and by September of the same year a labor force of 1800 men had gone to work on the canal. Everything seemed to be on the right track; Roosevelt expected to see "the dirt fly,"

but he was disappointed. Predictably, difficulties arose in the command structure because the Isthmian Canal Commission in Washington was unfamiliar with the practical exigencies of Panama. Moreover, the man on the spot, Chief Engineer Wallace, was an indecisive man who never found an effective approach to the many challenges of his job. To make things worse, the health issue became virulent again as yellow fever and malaria cases increased considerably in the spring of 1905. Dr. Gorgas, the chief sanitary officer, quickly countered this danger by an energetic campaign against Aedes and Anopheles mosquitoes which had been identified as carriers of the diseases. As a result, yellow fever was completely wiped out and malaria greatly reduced, but the short flurry of fatal infections had been very detrimental to the workers' morale. Poorly led and beset by medical problems, the American canal offensive began to sputter and stall before it had been fully launched.

President Roosevelt acted swiftly. Dr. Gorgas received all the money he needed for his mosquito warfare, and in July 1905 Wallace was replaced as Chief Engineer by John F. Stevens, whose authority was strengthened at the expense of the unproductive Isthmian Canal Commission. Immediately things began to fall into place. Stevens (Fig. A) was a tough, blunt pioneer type with a reputation for "always being in the right place at the right time and doing the right thing without asking questions about it."[4] He greatly improved the command structure and the general performance of the canal army by establishing what he called "the only policy that leads to efficient administration: to give the official ample authority and hold him strictly responsible for results. Such a policy encourages initiative, which is a most valuable asset to an engineer."[5]

Stevens not only knew how to handle the labor force, he also had no doubt where to concentrate it. In the 1890s, he had built the Great Northern Railroad across the Rocky Mountains. This railroad experience proved to be an ideal prerequisite for the excavation of the Panama Canal which, after all, "was simply a problem of transportation," as Stevens concluded correctly. In keeping with this conclusion he made every effort to "devise such a system of trackage, as would permit the maximum number of immense steam-shovels to be operated with the least possible interference with each other."[6] Apart from that, Stevens built up a machine park, a supply system and housing facilities for a labor force which was eventually to reach a size of over 60,000 people (families included). Put differently: in contrast to Wallace, Stevens understood very well that a complex infrastructure had to be established before excavation and construction work could begin in earnest. Consequently he concentrated all his resources on these preparatory activities, postponing the deployment of a full-fledged construction army and the "flying of the dirt" to a later stage.

After a year and a half, the necessary groundwork was completed, the long-delayed decision in favor of a lock canal (rather than a sea-level passage) had been taken and a transition to actual construction work could be made—just in time for a grand event that emphasized the high rank given to the canal enterprise among national priorities: President Roosevelt paid a three-day visit to the Canal Zone, bringing with him a large contingent of newspaper men eager to report on the first foreign trip ever made by a President of the United States while in office. There was no real necessity for this spectacular excursion, but, apart from satisfying Roosevelt's great natural curiosity, it enhanced the general popularity of the Panamanian venture, facilitated future appropriations in Congress and also raised the morale of the labor force to a new high. How much, indeed, the President was striving for this latter effect can be gathered from a kind of pep talk he delivered to American engineers at Colon on November 17, 1906:

> As I have seen you at work, seen what you have done and are doing, noted the spirit with which you are approaching the task yet to be done, I have felt just exactly as I should feel if I saw the picked men of my country engaged in some great war. I am weighing my words when I say that you here who do your work well in bringing to completion this great enterprise will stand exactly as the soldiers of a few, and only a few, of the most famous armies of all the nations stand in history. This is one of the great works of the world; it is a greater work than you yourselves at the moment realize. . . . I go back a better American, a prouder American, because of what I have seen the pick of American manhood doing here on the Isthmus.[7]

It was a speech likely to please the men on the job and to cheer them on to even harder work. Chief Engineer Stevens, however, was too much of a pragmatist and rugged individualist to be impressed by Roosevelt's patriotic equation of labor force with army. On the contrary, such rhetoric seems to have contributed to his sudden decision to relinquish his position. As he bluntly stated in his letter of resignation to the President: "The 'honor' which is continually being held up as an incentive for being connected with this work, appeals to me but slightly. To me the canal is only a big ditch, and its great utility when completed, has never been so apparent to me, as it seems to be to others."[8]

Roosevelt, of course, was furious, ascribed Stevens' lack of job commitment to "insomnia" and "tropical surroundings"[9] and had a successor appointed within days. This time it was a man who would follow orders—Col. George W. Goethals of the U. S. Army. Goethals added a political dimension to the office of Chief Engineer that had previously been absent. He presided over military exercises on the Isthmus, he delivered patriotic speeches, he entertained congressmen on Panamanian inspection trips, he lobbied in Washington and he even wrote a book in support of his legislative proposals.[10] Basically, he conceived of the Panama Canal as a military installation, urged the construction of strong fortifications and wanted to station an army of 25,000 men on the Isthmus, but most of these ideas found few supporters in Congress.

While Col. Goethals' reign was more glamorous than Stevens', it was no less efficient and productive. Adopting a form of government then appropriately labeled as "benevolent despotism,"[11] he made sure that everybody lived comfortably within a strictly enforced hierarchy of salaries and fringe benefits that left no room for trade unions, and reduced non-Americans and non-

whites to second- and third-class employees. At the same time, Goethals was an adherent of "scientific management" and minute cost-keeping—absolute necessities in a publicly financed enterprise where every cent had to be accounted for at the end of the year.

The undertaking probably most typical of Goethals' leadership was the creation of a weekly newspaper, the *Canal Record,* in which every expenditure and all work progress were faithfully documented. The publication of these regular reports was doubly useful. While they fostered a spirit of competition in the work force (every steam-shovel crew wanted to post the biggest weekly output), they also kept the American public informed about and supportive of the canal project, which by and by turned out to be much more expensive than had been anticipated in 1903. The higher costs were caused in part by the installation of the locks with their massive concrete walls, sophisticated steel machinery and elaborate safety measures which nobody had foreseen at the outset. Equally unexpected was the fact that the piercing of the mountain range at Culebra was greatly complicated by huge slides which added considerably to the total volume of excavation. The problem grew so severe that at times the successful completion of the canal seemed to be in jeopardy, but patient digging prevailed eventually, the width of the canal trench being tripled in the process.

Clearly, the canal battle was to be won or lost at Culebra. As the most critical and also the most impressive construction feature, the Cut attracted visitors by the thousands. One of them described the extraordinary sight in vivid terms:

> He who did not see the Culebra Cut during the mighty work of excavation missed one of the great spectacles of all ages. . . . From its crest on a working day you looked down upon a mighty rift in the earth's crust, at the base of which pigmy engines and ant-like forms were rushing to and fro without seeming plan or reason. Through the murky atmosphere strange sounds rose up and smote the ear of the onlooker with resounding clamor. He heard the strident clink, clink of the drills eating their way into the rock; the shrill whistles of the locomotives giving warning of some small blast, for the great charges were set off out of working hours when the Cut was empty; the constant and uninterrupted rumble that told of the dirt trains ever plying over the crowded tracks; the heavy crash that accompanied the dumping of a six-ton boulder onto a flat car; the clanking of chains and the creaking of machinery as the arms of the steam shovels swung around looking for another load; the cries of men, and the booming of blasts. Collectively the sounds were harsh, deafening, brutal such as we might fancy would arise from hell were the lid of that place of fire and torment to be lifted.
>
> But individually each sound betokened useful work and service in the cause of man and progress. . . .[12]

In the fall of 1913 all machinery was removed from Culebra Cut and its bottom was filled with water. The "first man-made canyon"[13] thus lost some of its most spectacular features, but came closer to fulfilling its practical destination. On August 15, 1914, well within the tentative timetable adopted at the outset of construction, the Panama Canal was inaugurated by S.S. *Ancon* which traversed the waterway from one end to the other in 9 hours and 40 minutes. Instead of the $135 million anticipated in 1903, a grand total of $352 million had been expended, but it was a good investment. Up to the present day the Panama Canal has continued to function smoothly without any noteworthy technical modifications.

The construction of the Panama Canal was an industrial venture of such magnitude, and President Roosevelt promoted it in such spectacular ways, that it was bound to attract enormous public attention. Over a span of ten years, beginning in 1904, countless books and newspaper and magazine articles were published on Panamanian subjects, many of them richly illustrated with photographic reproductions. In fact, along with the Spanish-American War and the San Francisco earthquake, the canal enterprise was one of the first major news stories to benefit fully from the perfection of photomechanical printing processes at the end of the nineteenth century. Before that time, photography had been a less than ideal recording medium because it had to be laboriously "translated" into line drawing to be put in mass circulation. Only in the 1890s had efficient gravure and halftone techniques become available which permitted the direct, quick and cheap reproduction of photographs in large book, newspaper and stereograph editions.[14] Commercial photography in general and photojournalism in particular were greatly boosted by this "halftone revolution." Assured of a new mass market for their pictures, various firms and individuals (Underwood & Underwood, Keystone, Brown Brothers, H. C. White and others) began to cover noteworthy events in a big way. Naturally the great news value of the Panama Canal was not lost on these photographers; taking regular trips to the Isthmus, they gradually compiled an awesome body of visual information that can still be studied in such magazines as *Harper's Weekly* or *Scientific American,* in stereographic sequences and in picture books.[15]

The present volume, however, is largely based on a different and rather special picture source: a negative archive of over 10,000 images amassed by Ernest Hallen, the Official Photographer of the Isthmian Canal Commission. Systematically covering every aspect of the construction activities and carrying meticulous captions, these images provide the best available basis for a photographic history of the construction of the Panama Canal. The well-preserved original negatives also guarantee excellent picture quality.

The presence of an Official Photographer on the Isthmus is probably less unusual than it may seem to the modern reader. As the exact opposite of "high-art" photography, camera coverage of industrial subjects has received little attention in photohistorical writings;[16] nevertheless, it represents a major and fascinating field of photographic activity throughout the nineteenth century. To avoid misunderstandings it should be stressed that we are not referring here to occasional snapshots of a machine, a factory or a laborer, but to the systematic documentation of a given industrial production process by a specially appointed photographer who remains on the job for months, if not years. Among the earliest examples of such comprehensive construction records are Delamotte's photographs of the Crystal Palace at

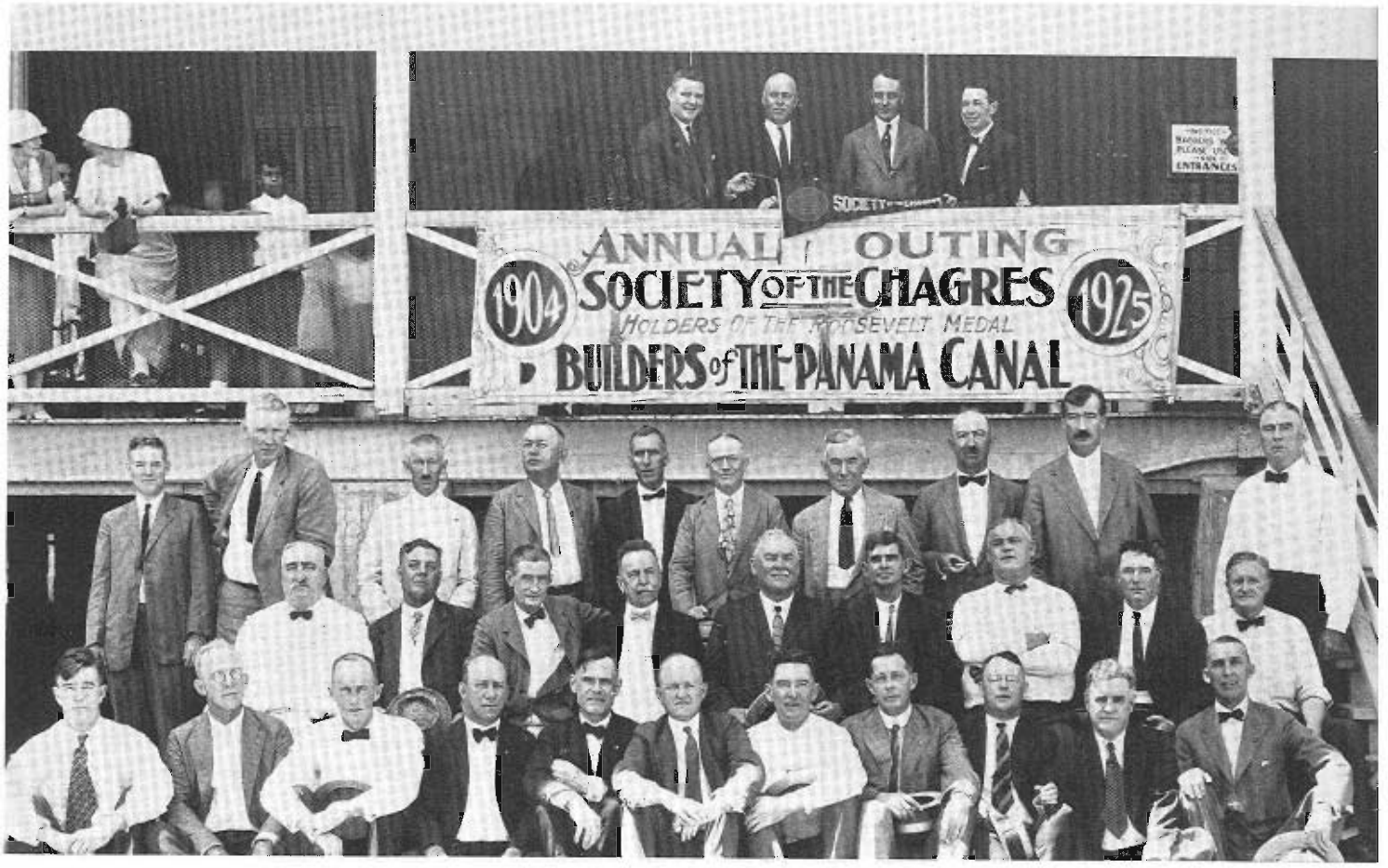


Fig. B. Chagres Society outing of 1925, with Hallen in the front row, fifth from the right.

Sydenham (1854–55), Howlett's *Great Eastern* sequence (1855–57) and Delmaet's and Durandelle's series of the Paris Opéra (ca. 1864–74).[17] While such documentary projects were mostly commissioned by private construction firms, government agencies were also very keen to obtain photographic records of major public works such as railroad lines and administration buildings. Numerous sequences of this kind were executed under Napoleon III. In American government departments, the employment of staff photographers became a fairly regular practice around 1900. From 1903 the Bureau of Reclamation even used a whole team of cameramen to document the progress of countless irrigation projects in the western part of the country.[18]

Thus it was only logical that an Official Photographer was attached to the large American work force in Panama, especially since the usefulness of pictorial canal records had already been proven by Lesseps, whose *Bulletin du Canal Interocéanique* had been enhanced hy numerous photographic illustrations. In fact, a good batch of these pictures (some of which carry the inscription "A. Blanc phot." and appear on the first pages of our selection) formed the nucleus of the photo archive later built up by Hallen, the American government photographer.[19]

The history of this archive remains somewhat clouded. On December 9, 1908, the *Canal Record* published a lengthy but vague article from which we can gather that a "picture history" of canal construction, consisting of "official photographs," was in the making.[20] The *Canal Record* also printed several circulars regulating the sale of the pictures. Apparently employees could buy "certain authorized photographs . . . at twenty gold cents each," but only after written application to the "Office Engineer who will authorize or disapprove the issue or sale of such photographs."[21] Unfortunately, the *Canal Record* does not point out when and upon whose initiative this photographic project was started, nor how it was structured. Although the photographer's name is withheld, it can be gathered from different sources.[22] Other pieces of evidence allow us to determine that Hallen arrived on the Isthmus on August 2, 1907, and that he stayed for at least 23 years—well beyond the actual construction period;[23] in the group picture of a Chagres Society outing in 1925 (Fig. B) he appears as the fifth from the right in the front row. In view of this long tenure there can be no doubt that Hallen produced the bulk of the "official" Panama Canal photographs preserved in the National Archives. However, since quite a few pictures can be dated before August 2, 1907,[24] a fairly systematic documentary project seems to have been under way one or two years before Hallen

appeared on the scene. Hallen must have had a predecessor whose identity may always remain a secret, especially since "official" canal photographs were consistently published without credit lines.

Nothing is known about Hallen's career before 1907 or his particular job qualification. Presumably he was a young man with an average photographic training but a more-than-average sense of adventure which prompted him to pursue his calling in the tropics. In looking through the huge archive that constitutes his life's work, it becomes obvious that he acquired adequate technical competence during his 23 years of service in Panama. However, there is no reason to veil the fact that his creative, artistic talents always remained modest. Before taking a picture Hallen saw to it that he had a good vantage point, that the subject was reasonably well lighted and that all important features were included in the frame; beyond that he seems to have had no ambitions. Unfortunately we possess no written information about his technical equipment, but the pictorial evidence points to the stereotyped use of a very limited arsenal. Invariably Hallen employed a view camera for $8'' \times 10''$ glass negatives. His lenses seem to have been of medium range since one never comes across any striking wide-angle or tele-effects. It was a basic, "no frills" photographic outfit, and it was used in a very conservative manner. Practically all of Hallen's pictures are "long shots," to use movie jargon; we hardly ever encounter a close-up or those unusual, surprising angles which were so popular with other industrial photographers, especially during the 1920s (e.g. Sheeler or Renger-Patzsch). Hallen's bland, unimaginative approach is particularly apparent in his group portraits, with their conventional or altogether accidental poses (illustrations 76, 98, 118, 131). In contrast, Hallen's anonymous predecessor seems to have had a considerable talent for the arrangement of delightful group compositions (nos. 77, 78, 97, 100).

No matter how limited Hallen's artistic abilities may have been, his pictures are great and impressive simply because he was fortunate enough to be dealing with a great and impressive subject. And he certainly made every effort to cover this subject as thoroughly as possible. The Canal Zone was dotted with construction sites, and Hallen visited every one of them on a regular schedule, setting up his camera on the same spot over and over again in pursuit of photographic sequences that can be read as visual progress reports. A small selection from a monthly or quarterly picture sequence of this kind is reproduced in nos. 121–124, showing the Miraflores lock site in its natural condition and in various subsequent construction stages.[25]

Apart from actual construction activities, Hallen also systematically documented the administrative structure, the housing and supply facilities and the social aspects of the enterprise. As the *Canal Record* reported in 1908:

> The human side of the great task is revealed in photographs of quarters, hotels, mess houses, clubs, and hospitals, and in pictures of men who do the work. No class is neglected. West Indians, Europeans, and Americans alike, are represented. The interiors and exteriors of the homes they live in, the places where they eat, the buildings assigned for recreation, churches and lodge rooms, baseball grounds—all phases of Canal Zone life have a place in this picture story of the Panama Canal.[26]

Altogether, Hallen amassed a remarkably comprehensive and diversified picture archive that could be used on several different levels. In the offices of the engineers the "official" photographs were carefully studied and filed as scientific documents that demonstrated special construction techniques and regular work progress on the various building sites. Apart from that, there were many thousand Isthmian workers and tourists who liked to buy "authorized" Hallen pictures for their souvenir value. But, most important, the Isthmian Canal Commission generously made its photographic records available to the printed media in the United States. Widely reproduced in government reports, books and magazines, they kept the taxpayer informed about the Panamanian venture and seem to have been quite instrumental in fostering public support despite soaring costs.[27]

While the popularity of Hallen's pictures dates back 70 years, they remain relevant today. The bills have long been paid, but Panama is still on our minds. Seen in historical perspective, many aspects of the great enterprise even begin to reveal a significance altogether hidden to contemporary observers. This is certainly true with respect to the political intricacies of a half-colonial adventure which do not concern us here. It is also true with respect to the bold technological efforts that guaranteed the canal's successful completion. Today we are living in an age of minicomputers and satellites which are inconspicuous in size but possess a capacity almost beyond human comprehension. Around 1900, industrial technology had a different face. It was still in a comparatively primitive stage, and there still was a close relation between the size and the power of a machine. A 95-ton steam shovel *was* huge and heavy and uncouth; its brute force *was* directly expressed in the massive proportions of its steel frame. To modern eyes these gigantic machines grinding through the Cut seem to have a prehistoric, dinosaurlike quality. They take us back to a different era, to what one might call the "heroic" age of industry.

In recent years we have generally become aware that technology has its own history, and even more than human vicissitudes, this history seems to follow highly dynamic, if not explosive patterns. We can daily make the observation that a small span of time may comprise an enormous leap in quality in the evolution of technical products. Put differently: as the pace of technical innovation accelerates, existing machinery becomes obsolescent more rapidly. In view of this it is only logical that the documentation of major historical achievements in the continuous flow of technological progress has become as vital a concern in our days as the search for ancient cities in Schliemann's time. In fact, industrial archaeology is in the course of establishing itself as a full-fledged academic discipline at many universities. It is not the least of Hallen's merits that his picture history of the Panama Canal provides us with a fascinating source for this new form of archaeological inquiry.[28]

Notes

1. This text (and the picture captions) are based on the following historical studies, which also can be recommended for supplementary reading: J. B. Bishop, *The Panama Gateway*, new and revised edition, New York, Charles Scribner, 1915; W. L. Sibert & J. F. Stevens, *The Construction of the Panama Canal*, New York, D. Appleton, 1915; W. J. Abbot, *Panama and the Canal in Picture and Prose*, New York, Syndicate Publishing Co., 1913; I. E. Bennett, *History of the Panama Canal: Its Construction and Builders*, Builder's Edition, Washington, D.C., Historical Publishing Co., 1915; G. Mack, *The Land Divided: A History of the Panama Canal and Other Isthmian Canal Projects*, New York, Alfred Knopf, 1944; J. and M. Biesanz, *The People of Panama*, New York, Columbia University Press, 1955; D. McCullough, *The Path Between the Seas: The Creation of the Panama Canal, 1870–1914*, New York, Simon and Schuster, 1977. The books by Mack and McCullough contain comprehensive bibliographies.
2. Josephus Acosta, *Natural and Moral History of the Indies*, 1625; quoted from Bennett, p. 120.
3. Bishop, pp. 126f.
4. Quoted from McCullough, p. 462.
5. J. F. Stevens, *An Engineer's Recollections*, New York, McGraw-Hill, 1936, p. 44.
6. Sibert & Stevens, pp. 76f.
7. T. Roosevelt, "Special Message of the President of the United States Concerning the Panama Canal, Communicated to the Two Houses of Congress on December 17, 1906," Washington, D.C., 1906, p. 16.
8. Quoted from McCullough, p. 504.
9. *Ibid.*, p. 505.
10. G. W. Goethals, *Government of the Canal Zone*, Princeton, Princeton University Press, 1915.
11. J. B. Bishop, *Goethals, Genius of the Panama Canal: A Biography*, New York, Harper, 1930, pp. 227 and 249.
12. *Abbott*, pp. 210f.
13. Bishop, *Panama Gateway*, p. 195.
14. See H. Gernsheim, *The History of Photography from the Camera Obscura to the Beginning of the Modern Era*, enlarged and revised edition, New York, McGraw-Hill, 1969, pp. 539 ff.; W. C. Darrah, *Stereo Views: A History of Stereographs and Their Collection*, Gettysburg, Pa., Times and News Publishing Co., 1964, pp. 114 and 117.
15. To name only a few picture books: *King's Views of the Panama Canal in the Course of Construction*, New York, Moses King, 1912; *Panama Canal Pictures, Showing the Latest Photographs of the Progress of Construction . . .*, Philadelphia, Wilmer Atkinson, 1913; *Photogravure Reproductions of the Panama Canal*, Passaic, N.J., The Rotary Photogravure Co., 1913; *The Panama Canal During Construction, From Photographs* by Edith H. Tracy, 1913, New York, Redfield Brothers, 1914. Also see Abbott and Bennett.
16. Sporadic references to industrial photography are made by Gernsheim throughout his comprehensive history; a good survey of the relevant American material has recently been published by J. Hurley: *Industry and the Photographic Image: 153 Great Prints from 1850 to the Present*, ed. by F. J. Hurley, New York, Dover, 1980.
17. For Delamotte's series *The Progress of the Crystal Palace, Sydenham*, see Gernsheim, p. 280. The unpublished series by Howlett and by Delmaet and Durandelle are preserved at George Eastman House, Rochester, N.Y.
18. The documentary projects carried out by the Bureau of Reclamation and various government agencies under Napoleon III are unpublished, but can be studied at the National Archives, Washington, D.C., and the Bibliothèque Nationale, Paris.
19. This fact and the reference to the *Bulletin du Canal Interocéanique* are given in: *Canal Record* 2, Dec. 1908, p. 115. Several photographs of French construction activities between 1886 and 1904 are preserved at the National Archives, Washington, D.C. Others are reproduced in: Ph. Bunau-Varilla, *Panama: The Creation, Destruction and Resurrection*, London, Constable, 1913. A complete run of Lesseps' *Bulletin* as well as photo albums of canal construction during the 1880s are preserved in the Bibliothèque Nationale, Paris.
20. *Canal Record* 2, Dec. 9, 1908, p. 115.
21. *Canal Record* 1, Feb. 12, 1908, p. 190.
22. We are referring here to two contemporary publications: F. J. Haskins, *The Panama Canal: Illustrated from Photographs Taken By Ernest Hallen, Official Photographer of the Isthmian Canal Commission*, New York, Doubleday, Page and Co., 1913; E. Hallen, *The New Pacific Fleet through the Panama Canal, July 1919*, Newark, N.J., Panama Pictorial Co., 1919.
23. The arrival date given in *Canal Record* 7, April 22, 1914, p. 332. As far as I know, Hallen's last appearance in a group portrait occurred in 1930, but he may have stayed in Panama several years longer.
24. Some are dated 1905 and 1906; others can be attributed to this early period on the basis of the caption style. Still others were published before 1907; see especially Roosevelt's illustrated message to Congress, quoted in note 7, above.
25. Unfortunately Hallen's negative collection at the National Archives does not seem to contain any complete sequence of monthly exposures of a given site. From the negative numbering system it can be concluded that originally these sequences were much more comprehensive. Apparently a good many negatives were "weeded out" some time before the collection was transferred from Panama to Washington, D.C.
26. *Canal Record* 2, Dec. 9, 1908, p. 115.
27. See especially the photographically illustrated *Annual Reports of the Isthmian Canal Commission*, 1904–1914.
28. For an introduction to industrial archeology see: K. Hudson, *Industrial Archaeology: An Introduction*, second revised edition, Cambridge, Cambridge University Press, 1967.

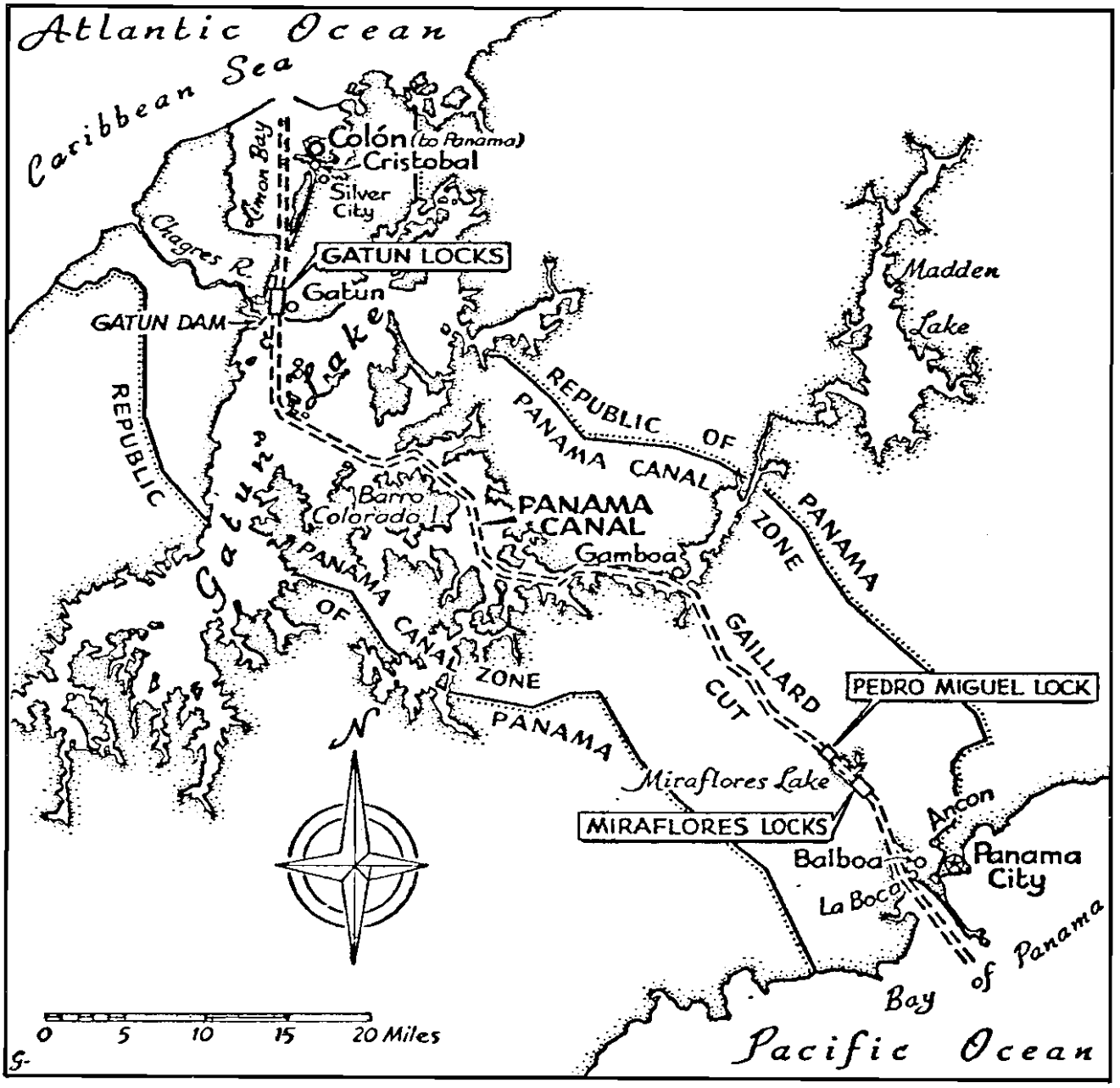
Picture Credits and Sources

Photographers

Anonymous: 1, 3, 4, 28, 59, 61
A. Blanc: 2
W. A. Fishbaugh: 29, 58, 60
Marine: 11
Underwood & Underwood: 32, 33, 86
H. C. White: 34
All other photographs are by Ernest Hallen or his unknown predecessor in the capacity of "Official Photographer of the Isthmian Canal Commission."

Sources

Almost all pictures are reproduced from negatives, prints or lantern slides in the National Archives, Washington, D.C. The only exceptions are:
32, 33, 34: *Harper's Magazine* 50, Dec. 8, 1906
59: W. J. Abbot, *Panama and the Canal in Picture and Prose*, New York, Syndicate Publishing Co., 1913
Introduction Fig C: J. and M. Biesanz, *The People of Panama*, New York, Columbia University Press, 1955


Atlantic Ocean
Caribbean Sea
Colón (to Panama)
Cristobal
Silver City
Limon Bay
Chagres R.
GATUN LOCKS
Gatun
GATUN DAM
Gatun Lake
REPUBLIC
Madden Lake
REPUBLIC OF PANAMA
PANAMA CANAL ZONE
Barro Colorado I.
PANAMA CANAL
Gamboa
GAILLARD CUT
PEDRO MIGUEL LOCK
Miraflores Lake
MIRAFLORES LOCKS
Ancon
Balboa
Panama City
La Boca
Bay of Panama
Pacific Ocean
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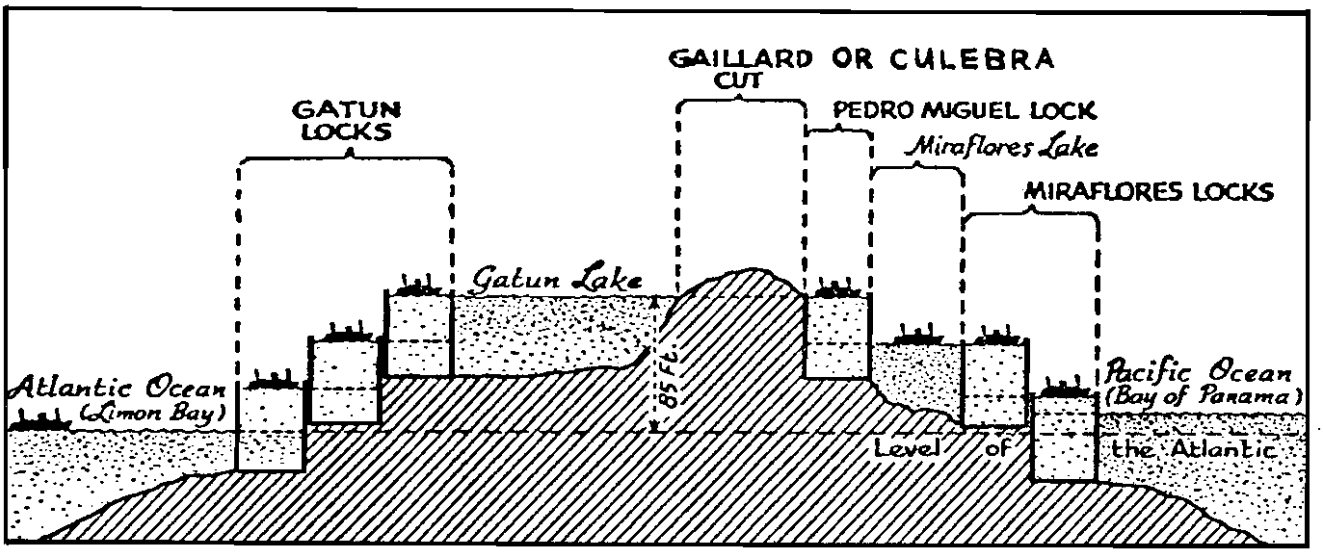
0 5 10 15 20 Miles


GAILLARD OR CULEBRA CUT
GATUN LOCKS
PEDRO MIGUEL LOCK
Miraflores Lake
MIRAFLORES LOCKS
Gatun Lake
85 ft.
Atlantic Ocean (Limon Bay)
Pacific Ocean (Bay of Panama)
Level of the Atlantic

Cristobal to Balboa

A Boat Trip through the Panama Canal

[The following text was written some time before the first ship entered the canal and is therefore half-fictive. However, since it describes not only the future, completed state of the canal, but also various construction phases it provides an ideal introduction to our pictures, which focus on building activities. The text is quoted with abridgments from: Willis J. Abbot, *Panama and the Canal in Picture and Prose*, New York, Syndicate Publishing Co., 1913, pp. 135 ff.]

[If a visitor] desired to see the canal in its completed state—say after 1914—he would take a ship at the great concrete docks at Cristobal [no. 110]. . . . Steaming out into the magnificent Limon Bay, the vessel passes into the channel dredged out some three miles into the turbulent Caribbean, and protected from the harsh northers by the massive Toro Point breakwater. The vessel's prow is turned toward the land, not westward as one would think of a ship bound from the Atlantic to the Pacific, but almost due south. The channel through which she steams is 500 feet wide at the bottom, and 41 feet deep at low tide. It extends seven miles to the first interruption at Gatun, a tide water stream all the way. . . .

At [Gatun] the shores rise higher and one . . . will be able to clearly discern far ahead a long hill sloping gently upward on each side of the canal, and cut at the center with great masses of white masonry, which as the ship comes nearer are seen to be gigantic locks, rising in pairs by three steps to a total height of 85 feet [nos. 62, 68]. . . .

Up to this time the ship had been proceeding under her own steam and at about full speed. Now slowing down she gradually comes to a full stop alongside the central guide wall. Here will be waiting four electric locomotives, two on the central, two on the side wall. Made fast, bow and stern, the satellites start off with the ship in tow [no. 127]. It will take an hour and a half to pass the three locks at Gatun. . . .

[As] the ship steams into the open lock the great gates which are to close behind her and hold the water which flows in from below, slowly lifting her to the lock above, are folded flush with the wall, a recess having been built to receive them. The chamber which the vessel has entered is 1000 feet long, . . . 110 feet wide and will raise the ship 28 ⅓ feet [nos. 119, 120 for the process at Miraflores]. If the ship is a comparatively small one the full length of the lock will not be used, as intermediate gates are provided which will permit the use of 400 or 600 feet of the locks as required—thus saving water, which means saving power, for the water that raises and lowers the ships also generates electric power. . . .

Back of each pair of gates is a second pair of emergency gates folded back flush with the wall and only to be used in case of injury to the first pair [no. 125 for gates at Miraflores]. On the floor of the canal at the entrance to the lock lies a great chain, attached to machinery which, at the first sign of a ship's becoming unmanageable, will raise it and bar the passage. Nearly all serious accidents which have occurred to locks have been due to vessels of which control has been lost, by some error in telegraphing from the bridge to the engine room. For this reason at Panama vessels once in the locks will be controlled wholly by the four locomotives on the lock walls . . . . Finally at the upper entrance to the locks is an emergency dam built on the guide wall [no. 128]. . . . [This dam will be activated] if an accident should happen to the gates of the upper lock. . . . The machinery by which all is operated [no. 66] is concealed in the masonry crypts below, but the traveler may find cheer and certainty of safety in the assurance of the engineer who took me through the cavernous passages—"It's all made fool proof".

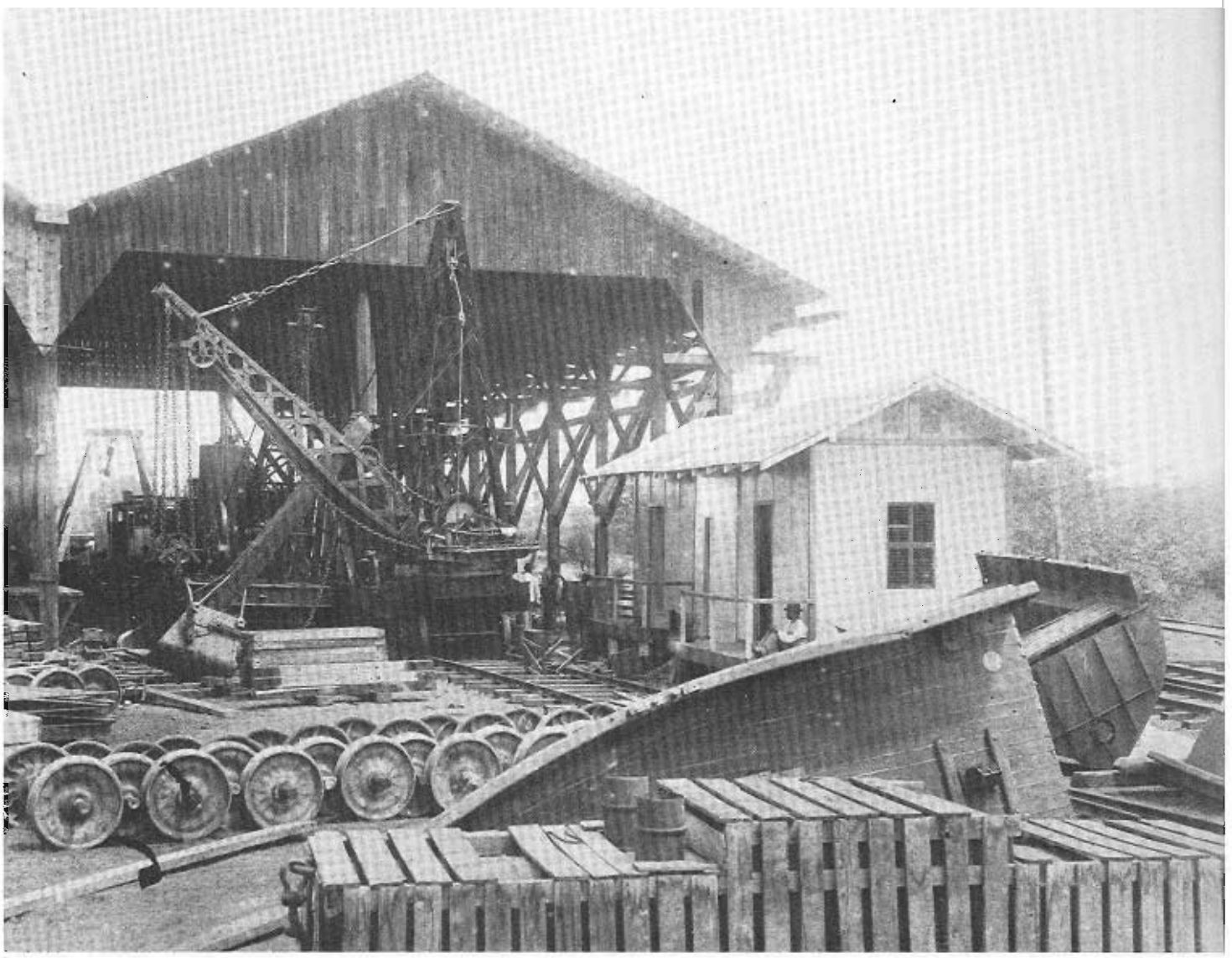
Leaving the Gatun locks and going toward the Pacific the ship enters Gatun Lake, a great artificial body of water 85 feet above tide water. This is the ultimate height to which the vessel must climb, and it has reached it in the three steps of the Gatun locks. To descend from Gatun Lake to the Pacific level she drops down one lock at Pedro Miguel, 30 ⅓ feet; and two locks at Miraflores with a total descent of 54 ⅔ feet. . . . Gatun Lake constitutes really the major part of the canal, and the channel through it extends in a somewhat tortuous course for about twenty-four miles. So broad is the channel dredged—ranging from 500 to 1000 feet in width and 45 to 85 feet in depth—that vessels will proceed at full speed, a very material advantage, as in ordinary canals half speed or even less is prescribed in order to avoid the erosion of the banks.

The lake . . . will in time become a scenic feature of the trip that cannot fail to delight those who gaze upon it. But for some years to come it will be ghastly, a living realization of some of the pictures emanating from the abnormal brain of Gustave Doré [no. 96]. On either side of the ship gaunt gray trunks of dead trees rise from the placid water, draped in some instances with the Spanish moss familiar to residents of our southern states, though not abundant on the Isthmus. More of the trees are hung with the trailing ropes of vines once bright with green foliage and brilliant flowers, now gray and dead like the parent trunk. Only the orchids and the air plants will continue to give some slight hint of life to the dull gray monotony of death. . . .

The waters of the lake cover 164 square miles and are at points eighty-five feet deep. In the main this vast expanse of water . . . is supplied by the Chagres River, though several smaller streams add to its volume. Before the dam at Gatun was built two or three score yards measured the Chagres at its widest point. Now the waters are backed up into the interior far beyond the borders of the Canal Zone, along the course of every little waterway

Fig. C. Map of the Panama Canal Zone, showing the levels of the canal.

THE BUILDING OF THE PANAMA CANAL in Historic Photographs

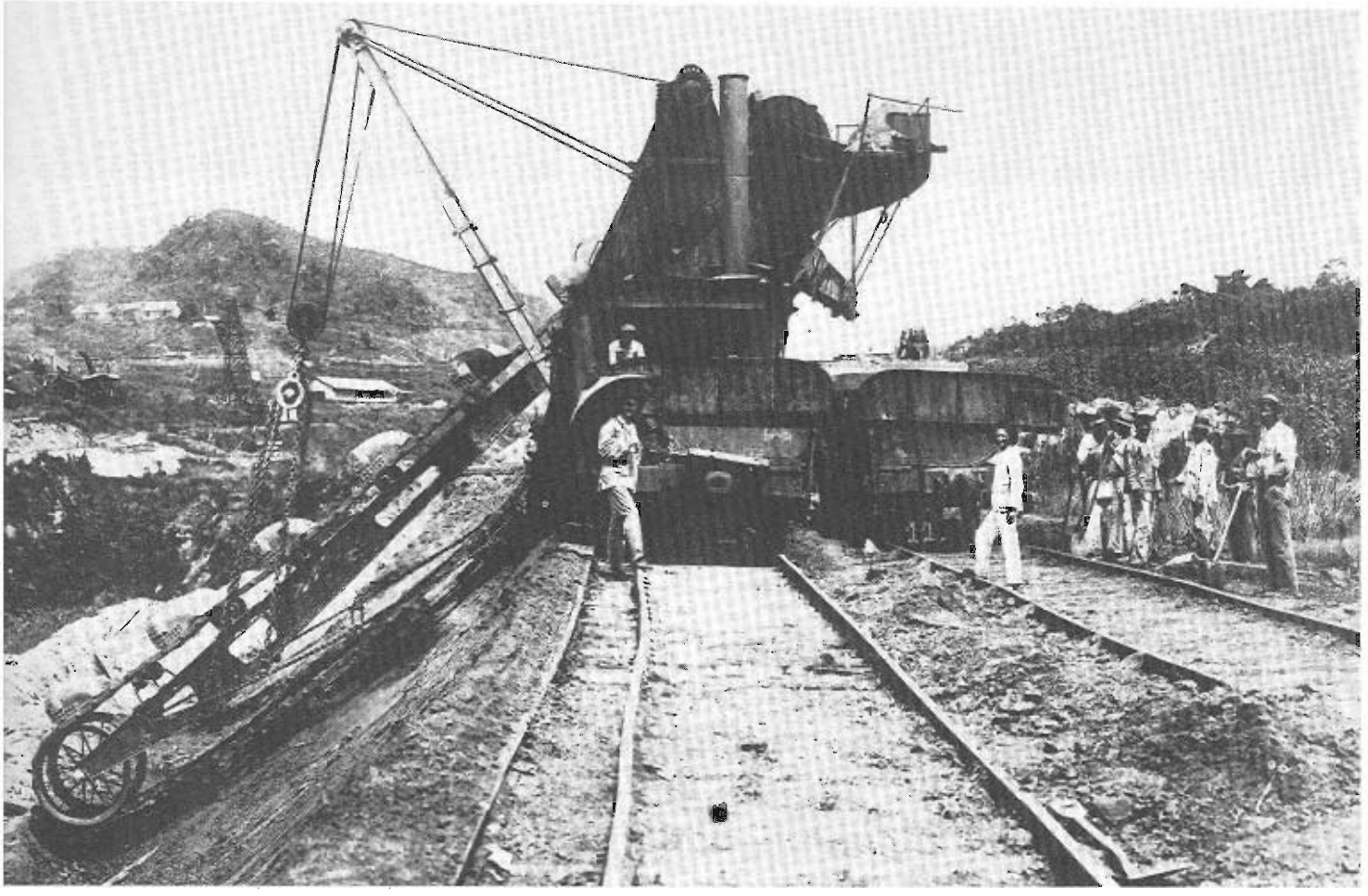


1

The French Fiasco (nos. 1–4). Ferdinand de Lesseps, celebrated builder of the Suez Canal, tackled the project of a canal in Panama in 1879. A colossal stock company was formed, many shiploads of men and machinery went to Panama, an awesome amount of excavation was accomplished, but in eight years the whole undertaking ended in the biggest financial fiasco of the century. Apparently, there were four principal reasons for Lesseps' failure: malaria and yellow fever exacted a terrible death toll of over 22,000 men; the French machinery was too light and lacking in standardization; the use of 200 poorly coordinated contracting firms resulted in high expenses and low efficiency; and the plan for a sea-level canal was unrealistic to begin with.

1. Assembly of Osgood steam shovel at Colon, ca. 1886–88. The French relied on American-made steam shovels that had a modest dipper capacity of two cubic yards and could be used only on soft earth, rather than rock.

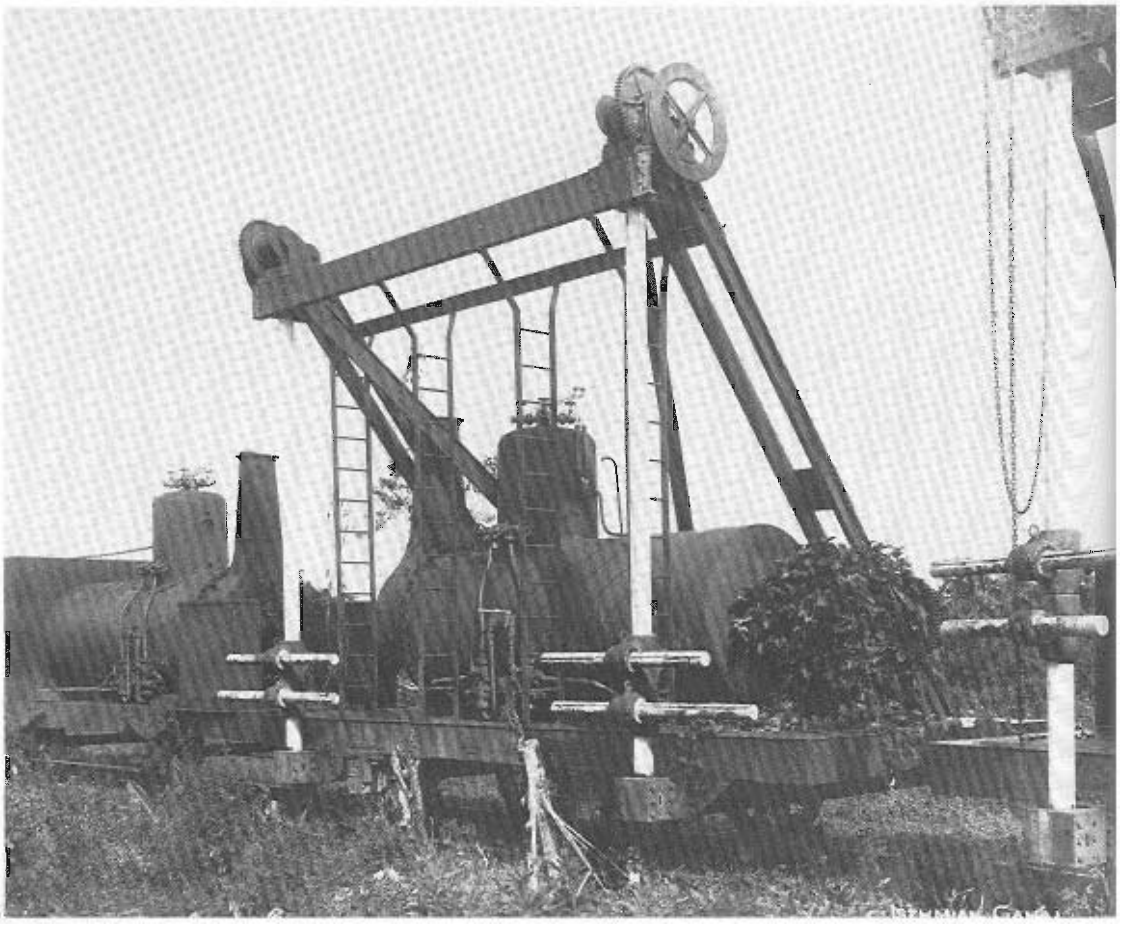
2



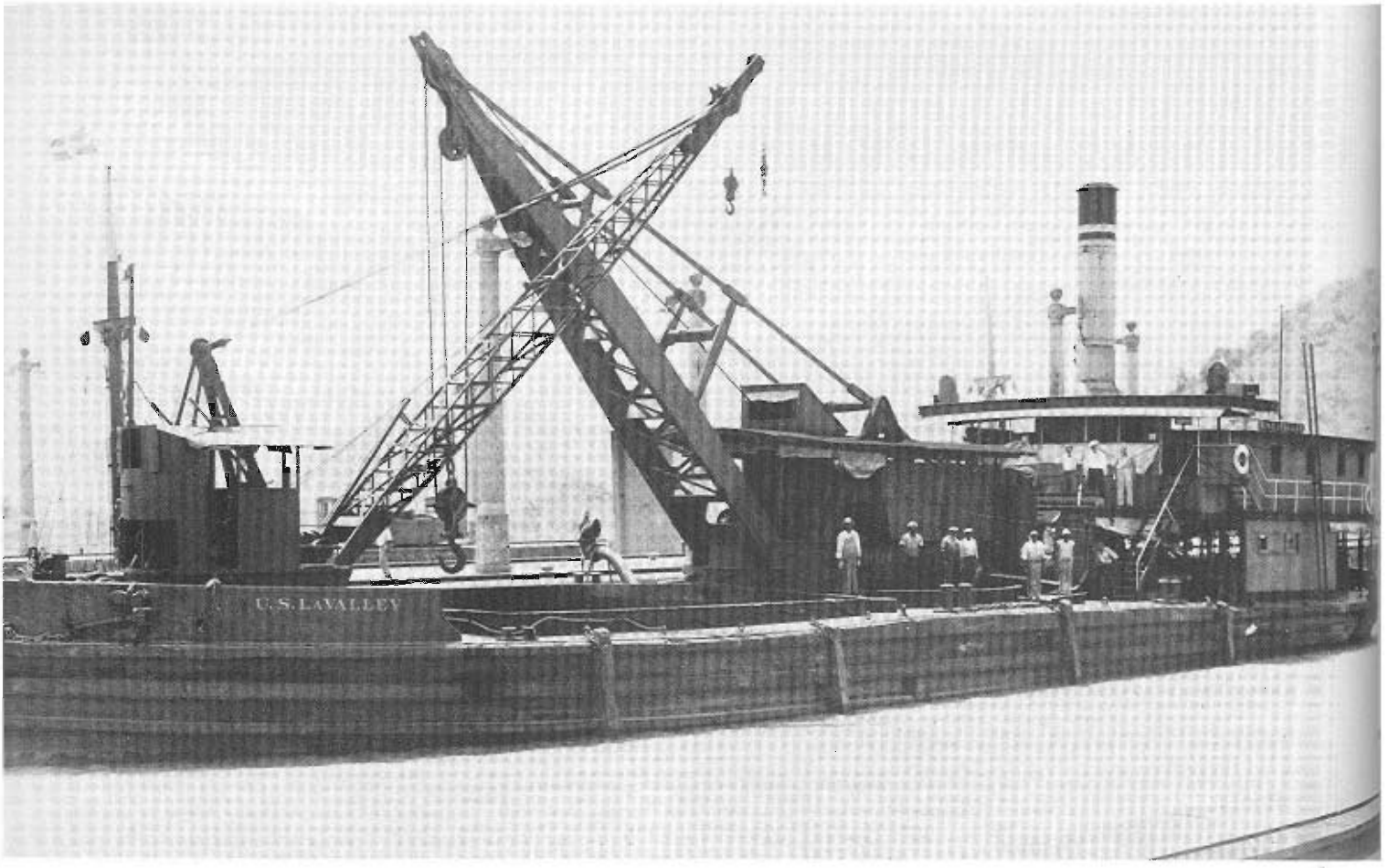
3

4

2. The hilltop at Bas Obispo torn up by dynamite, August 1886. The French dump cars had a capacity of five to eight cubic yards. In the rainy season they often had to be unloaded by hand because the dirt stuck to the planks. **3.** Excavator at work near Empire, ca. 1886–88. Averaging 400 cubic yards a day, the French chain-bucket excavators were less efficient than the steam shovels, which could handle three to four times more. The chain buckets had a volume of three to six cubic feet and emptied their loads on dump cars placed alongside the excavator. **4.** Culebra Cut between Culebra and Empire, 1898. After the liquidation of Lesseps' canal company in 1889, French construction work was continued on a small scale by a new company to retain the Colombian building concession.



5



6