

THE GATUN DAM

BY FORBES LINDSAY



Excavation for Spillway Gatun

THE Gatun Dam has a well-established position as the keystone of the canal. The charges used to be the arch-bogy, but now the structure which is designed to restrain that voracious stream has usurped the first place in the interest and apprehension of the public. The criticisms and suspicions that have been directed against the great dam can only be accounted for by the fact that it is the key to the whole plan and the most essential feature of it. Any derelict that can be cast upon it affects the entire lock level project, and so the opponents of the canal concentrate their attacks on what they consider the most vulnerable quarter. The average individual, lacking technical knowledge of the subject, is prone to accept these strictures. To him the mere size of the huge mound involves a menace. But this is a mistaken view. As a matter of fact, a considerable degree of its safety lies in its enormous bulk and weight.

The Gatun Dam will fill the gap in the hills enclosing the Valley of the Chagres, through which that river passes on its way to the Atlantic Ocean. The obstruction of its course will force the stream and its tributaries to empty on the upper side of the dam and to form a lake about 10 miles in extent. The water in this immense reservoir will stand at an elevation of 85 feet above sea level and its depth will range from 45 to 75 feet, so that very little excavation will be needed. The canal course across Gatun Lake will be 23 miles in length, or more than half the entire distance from shore to shore. Along this stretch ships will have the advantage of open and unrestricted navigation.

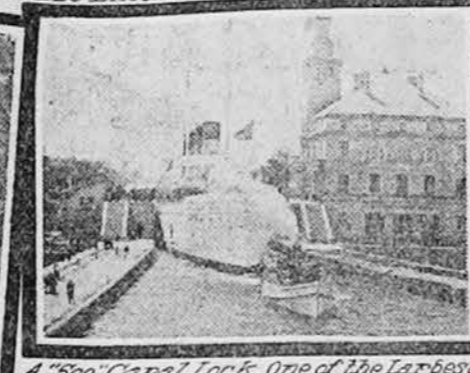
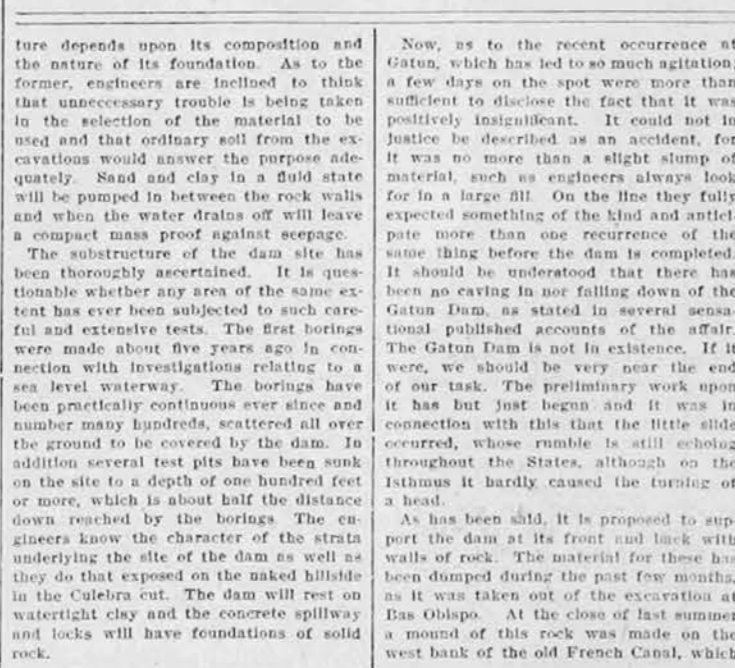
Gatun Dam will stretch across the valley in a length approximating one and a half miles. Its crest will be 125 feet above sea level and from that it will slope down to 60 feet, the distance from face to toe being half a mile. It will be composed of selected material impervious to water and reinforced along its front and back by heavy walls of rock. The dam will exert a weight upon its foundations of one ton to every 20 feet of height, so that under the great pressure will be nearly seven tons to the square foot. The safety of such a structure depends upon its composition and the nature of its foundation. As to the former, engineers are inclined to think that unnecessary trouble is being taken in the selection of the material to be used and that ordinary soil from the excavations would answer the purpose adequately. Sand and clay in a fluid state will be pumped in between the rock walls and when the water drains off will leave a compact mass proof against seepage.

The substructure of the dam site has been thoroughly ascertained. It is questionable whether any area of the same extent has ever been subjected to such careful and extensive tests. The first borings were made about five years ago in connection with investigations relating to a sea level waterway. The borings have been practically continuous ever since and number many hundreds, scattered all over the ground to be covered by the dam. In addition several test pits have been sunk on the site to a depth of one hundred feet or more, which is about half the distance down reached by the borings. The engineers know the character of the strata underlying the site of the dam as well as they do that exposed on the naked hillside in the Culebra cut. The dam will rest on watertight clay and the concrete spillway and locks will have foundations of solid rock.

Now, as to the recent occurrence at Gatun, which has led to so much agitation; a few days on the spot were more than sufficient to disclose the fact that it was a perfectly insignificant accident. It could not in justice be described as an accident, for it was no more than a slight slump of material, such as engineers always look for in a large fill. On the line they fully expected something of the kind and anticipated more than one recurrence of the same thing before the dam is completed. It should be understood that there has been no caving in nor falling down of the Gatun Dam, as stated in several sensational published accounts of the affair. The Gatun Dam is not in existence. If it were, we should be very near the end of our task. The preliminary work upon it has but just begun and it was in connection with this that the little slide occurred, whose rumble is still echoing throughout the States, although on the Isthmus it hardly caused the turning of a head.

As has been said, it is proposed to support the dam at its front and back with walls of rock. The material for these has been dumped during the past few months, as it was taken out of the excavation at Bos Obispo. At the close of last summer a mass of this rock was made on the west bank of the old French Canal, which runs through the dam site and will eventually be covered by the structure. This portion of the rock wall was 90 feet high in one place and sloped toward the channel. It stood for three months without any movement. In November the engineers began to pump the water out of the old canal in order to remove from its bed the soft material which has accumulated since the cut was made and which would be undesirable to leave beneath the dam. Just at this time unusually heavy rains caused floods along the line and a temporary lake was formed on the side of the rock mound, opposite to that on which the canal ran. As a result great pressure was exerted against the mass of material on one side, whilst the resistance was decreased on the other by the removal of the water from the cut. In consequence, the heap of rock slid a few feet into the old canal and at the same time a small portion of it sank into its foundation to a depth of somewhat less than seven feet. It was this trivial occurrence, which an engineer would hardly deem of sufficient importance to include in his annual report, that furnished the text for columns of alarming criticism. The question will naturally arise to the mind of the reader: "Why, if there was no greater cause for anxiety, did Mr. Taft go to the Isthmus accompanied by a special investigating commission?" As to that, it can only be said that the President chose a somewhat cumbersome and indirect method of quieting the clamor and easing the public mind. He was fully satisfied with the explanation of the affair immediately advanced by the commission and the chief engineer, and they were given to understand that such was the case. It was clearly understood on the spot that the purpose of appointing the special board of engineers was solely to restore public confidence, and none knew better than the men engaged in the work that the visiting commission could not make any sort of effective investigation in the time allowed to them. A month or two would have been necessary for the accomplishment of such a task. As it was they were compelled to rely upon the statements of the engineers on the line, which there is no reason to believe were in the slightest degree perverted of the facts. The work on the canal is proceeding with admirable smoothness and dispatch. The men on whom the chief responsibility rests are proving themselves to be quite equal to the task, and, if allowed to proceed without unnecessary interruptions,

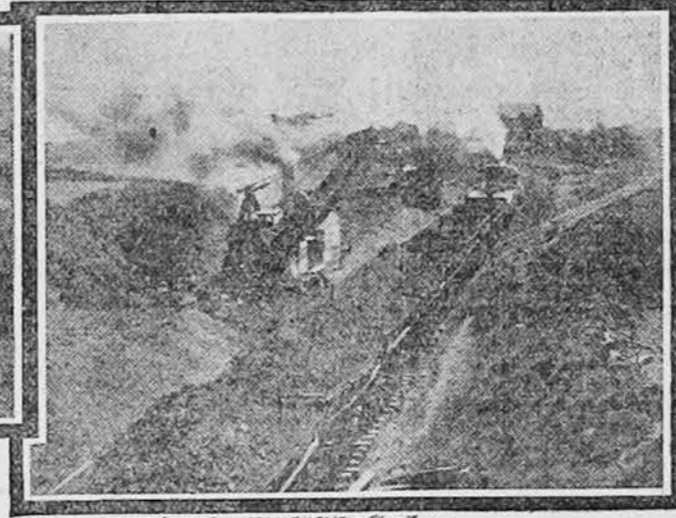
Lock and Dam Site, Gatun



A 500 Canal Lock, One of the Largest in America but only one-half as Large as Those Proposed for Gatun



After a Blast



Excavating for Lock Site, Gatun

such as the recent "Investigation," will complete it in the time set by them—that is to say, before the close of the year 1915. It has been so to speak, uphill work until the present. We are just at the point of starting down grade. Absolutely all the data necessary is in hand. The ground is ready for the work of building the concrete structures by which the termination of the operation will be regulated. Contracts have been let for the machinery and cement to be used in the construction of the dams and locks and two large vessels have been bought to transport the material. A change of plan might be made now with little loss for the work done so far would apply to a sea-level waterway, but heretofore every day's work will turn to a dead loss in case the type of canal is altered.

The construction of the locks at Gatun, Pedro Miguel and Miraflores will commence simultaneously, and will be pushed with all possible speed. It is proposed to consume about 8,000 barrels of cement a day. Half this amount will be used at Gatun alone, where 20 mixers are to be installed along the line of the lock walls.

FORBES LINDSAY,
Author of
"Panama, the Isthmus and the Canal."

Could Germany Suppress England?

ENGLISHMEN—those usually calm and placid individuals—are now and have been for a year all aflame over an alleged plot of Germany to suddenly land her superb army of, say 200,000, of the best drilled soldiers in the world on the east shore of England. Any number of special articles have been written on the subject, the statesmen have been questioned and bullied in Parliament about the matter, and a dozen novels and half as many very popular melodramas have been written on the subject.

Sir John Fisher, who is generally considered the greatest of the fighting admirals of England of this day and generation, has evidently given much time and attention to studying the possibility and the feasibility of Germany ever attempting to accomplish this tremendous feat. Sir John says of the idea:

"I am of the opinion that it could happen far more easily than most people think. With submarines by day and torpedo-boat destroyers sweeping the seas at night, the North Sea will be an impossible place for battleships in war. The big fleets of both parties will lie behind booms and defenses at their bases most of the time, each waiting to attack the other, but unwilling to venture out except on concerted plans of battle.

"The destroyers will fight one another and every old cruiser and old fashioned gunboat will be sent out. There will be many small battles, partial actions and so forth, and at any time Germany might succeed in rushing an invading army across the Channel. These might meet destroyers, but Germany has many more of these particular craft than England.

"But the real danger lies in the fact that Germany might come from the Cuxhaven direction or just as probably go around inside the Baltic and come out at the north of Denmark. British ships could watch one direction could not do so in the other.

"A remedy is imperative and the only way to safety lies on the water. There must be many new boats built to watch the exits from Germany's ports. They do not have to be very fast or extremely powerful, but they must be built and kept on the watch, for as sure as Great Britain and Germany ever go to war the latter country will attempt to invade England and capture London."

How Battleships Age

U.S. Scout Cruiser "Chester" the fastest vessel in the Navy

Machine Shops and Construction Yard at the Brooklyn Navy Yard

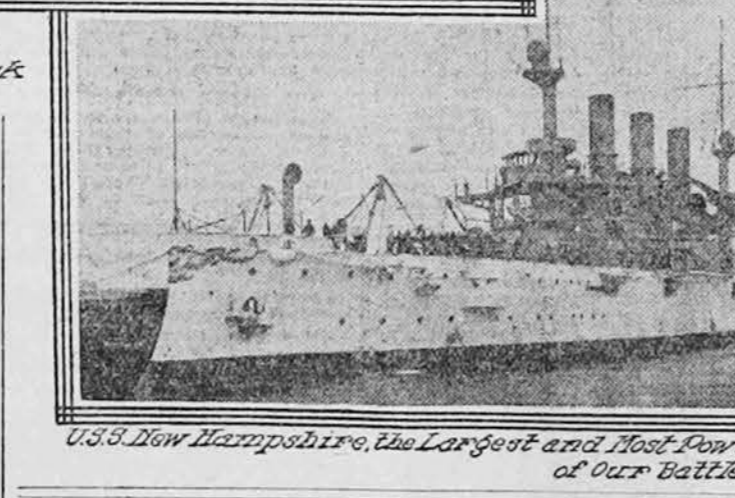
Crew of the Battleship New Hampshire on the Forward Deck

ONE of the greatest problems that confront the experts of our Navy is the rapidity with which the modern ships of war age, for try as they may, the constructors cannot prevent the present-day battleships from becoming back numbers in a few short years. The average period during which armored ships are considered first-class vessels ranges from between four to six years, while any warship over that age is generally held up as an object lesson of what a great sea fighter of the present day ought not to be.

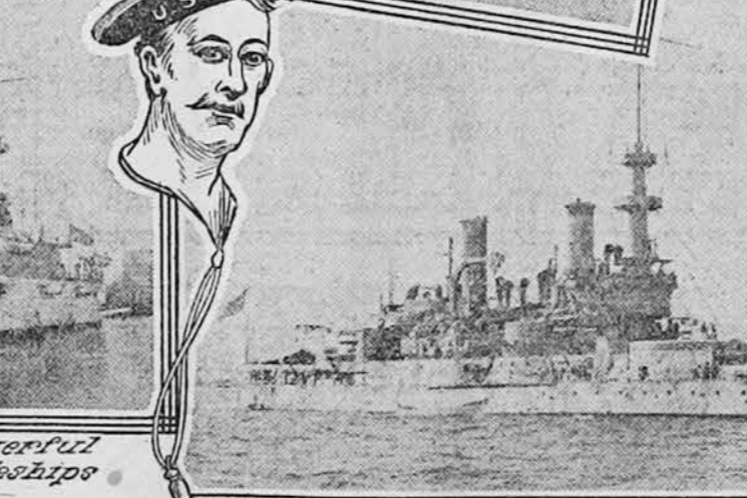
Take the battleships Massachusetts and New Hampshire for instance; these illustrate how short a period a modern battleship ranks as a first-class sea fighter. Ten years ago the Massachusetts was one of the largest and most powerful warships in the world, and it was claimed that she could sink, in less than an hour, the best vessel flying the flag of this or any other nation. Today this famous vessel is a back number and would be easy picking for most of the battleships now in commission in the American Navy.

In striking contrast to the Massachusetts is the battleship New Hampshire, the newest addition to Uncle Sam's fleet and considered by experts to be as powerful a war vessel as can be found in the world. No technical knowledge is needed to convince even the layman that the old vessel would be little more than a plaything in the hands of those who direct the movements of the modern leviathan. Experts say that the Massachusetts would sink in the storm of an onslaught by the New Hampshire as quickly as she would have done other vessels at her mercy 10 years ago.

A few weeks ago the North Dakota was launched, and when this giant battleship is finished and placed in commission the United States will have, for the first time in her history, a battleship that can truthfully be called the queen of the seas. She will be four thousand tons heavier than any vessel now in the American



U.S.S. New Hampshire, the Largest and Most Powerful of Our Battleships



U.S.S. Massachusetts, Our Oldest Battleship

Navy, and will have twice the tonnage of the first-class battleships of 10 years ago. The gun power on the North Dakota will be more destructive, the speed will be greater and the armor will be twice as impenetrable as was the case when the Massachusetts reigned supreme.

Man's ingenuity and his unceasing striving for perfection—his utter unwillingness to leave well enough alone—is at the bottom of the short life of the fighting ships. As soon as a warship is completed some fault is discovered in her construction and in the design of the next ship the defect is remedied. This applies equally to the engines and boilers, the guns, the armor plate and the interior mechanism. New inventions are being made right along and every day brings forth something new that holds out hope of increasing the efficiency of vessels.

Battleships are not the only class of vessels that age rapidly. The armored cruisers and gunboats show what is called "undness" five or six years after they are constructed. The cruiser Brooklyn, once called the peer of any vessel of her class in the American Navy and so far outclassed by the cruisers of today that she is just now about the age of the protected cruisers of a decade ago. A ship of her tonnage in the armored cruiser class was then considered a monster, as she had a displacement of 9,000 tons, and the battleships of those days were only 1,000 tons heavier.

Nowadays the armored cruisers are nearly 5,000 tons heavier than the vessels of the same class a decade ago, which, alongside of them, appear like pigmies in point of size. More than that, they even make the battleships of those days look insignificant. The latest of the speed monsters added to the navy is the Washington, with the gigantic displacement of 14,500 tons, and bigger in every way than the flagship of Rear Admiral Willard S. Schley during the battle of Santiago. The builders of this mammoth structure of steel claim that she is the most powerful vessel of her class in the American Navy and the equal of any ship of war that a foreign navy can boast of in the armored cruiser class.

The little torpedo boats of the Navy are the only vessels that do not seem to grow "out of style," no matter how long they have been in use. Of course, they are being built larger all the time, but the smaller craft, like the Stiletto, which has a displacement of 40 tons, are considered just as powerful as the modern Worden, which is nearly eleven times the size in displacement tons. The Navy Department expects much of these little fighters that constitute the "mosquito fleet." The manner in which they are

looked after, the extreme care taken never to let any part of them get out of order amounts almost to pampering. And, like all spoiled children, there are times when they behave shockingly bad. Swiftness and the ability to carry more and heavier guns are the main features required of the latest models in the big warship class. Ten years ago the main battery of the battleships consisted of four 12-inch guns, two in each turret fore and aft. After a short time it was discovered that 12-inch guns would be more practicable, and when the battleship Iowa was built they were installed in her as an experiment. The new guns worked so well that it was decided, after a conference, to have all the future battleships carry 12-inch guns. For many years no effort was made to increase the number of turrets on any one vessel, but on the newest ships the number of guns of the 12-inch variety has been raised to at least 16.

On the old vessels the four large guns could only be fired fore or aft at the same moment. On the new Dreadnoughts the turrets are so distributed that five times the number of guns will be fired at the enemy fore and aft, while the array of guns that can be discharged to port and starboard is expected to be four times as powerful as the modern Worden, which is nearly eleven times the size in displacement tons. The Navy Department expects much of these little fighters that constitute the "mosquito fleet." The manner in which they are

are submerged and are not visible, whereas, on vessels built in years gone by the one tube they carried projected two feet above the water line and was proportionately less effective. The torpedoes, too, used on the new vessels are far more powerful than those of former days.

Construction improvements in the machinery of the ships of the present day have kept step with progress in other directions. Every new and feasible idea obtainable is utilized by the men who design the battleship plans. What was considered the most improved pattern of mechanism a few years ago is looked upon almost with contempt today as antiquated and inefficient. The improvements may involve a great system of wheels and levers and they may mean merely the addition of a little screw. But it's a change and usually it is for the better. Of course, mistakes are made at times. In the machine shops in the Navy Yard they know of cases where new and costly inventions were installed only to prove absolute failures. But that doesn't mean that the constructors went back to the old and approved methods. They had been condemned beforehand, simply because they were old. What they did do was to rack their brains, spend sleepless nights and nerve-wearing days of toil—but the result was something new that did work. And for the time being it was the greatest improvement known.

As important a factor as any in the construction of a warship is the armor. On the ships of today the belt is from nine to twelve inches in thickness and

Every Spaniard a Noble.

It is interesting to realize that the lofty courtesy of the Spanish people is due to the fact that each pure-bred native of that sunny land considers himself a noble. While, of course, all are not granted to wear a title, still each Spaniard is deemed of noble birth if he has kept his pedigree clear of intermarriages with any but such as have also maintained the Spanish blood intact.

This belief has a sound historical basis. In the fact that when the Moors were driven from Spain the Spaniards, in reality, the ruling class from which the Spanish of pure blood of today are descended—all fought against the Moors, and all were of a military caste. And when the Moors were finally driven out of Spain there remained, besides the pure-blooded Spaniards, a great horde of mixed breeds.

So it was decreed by the Crown that every pure-bred Spaniard was an aristocrat and a member of the noble classes. Only such were eligible for titles and could hold any of the great court offices. All such were declared, Dons and the title of Don, or "master," applied to all Spaniards regardless of any other titles he might possess, and thus every Spaniard was a nobleman by virtue of his blood.

This curious situation continues in force to the present day. Of course, it seems as if there would be many individuals who could claim pure blood, but in reality, there are few families not of wealth and importance that can actually do this by authentic documents. Yet such is necessary to insure recognition as a pure-bred Spaniard.

It is needed to produce documents for many generations back, including birth certificates and marriage records. As a matter of fact, there are but few such Spanish families, which, in addition to their unalloyed descent, do not also own some title. Also, many Spanish noble families with titles would have to admit that they have intermarried with other than the pure Castilian blood.

Still, there are enough of the pure-blood Spaniards without title to prove the historical value of the fact that every pure-bred Spaniard is a member of the aristocracy and a noble by birth if not by a distinguishing title. It is all the more interesting when it is realized that Spain is the only country on the globe where such is the case.

Spain is still used as a medium of exchange for some parts of the Niger country, in Africa, but the government discourages it. Owing to the extreme conservatism in these districts the task is difficult.

Young Ostriches as Pets.

AN ostrich egg weighs some three pounds, and it is claimed it tastes so much like an ordinary hen's egg that you cannot tell the difference. Also one will make a meal for a family of five. There is said to be something fascinating about a baby ostrich, and they love to be petted and become very fond of their attendants. But beware of the grown ostrich. No matter how tame it has been as a young chick, the ostrich is untamable as an adult bird.

Nobody ever boasted of having a grown tame ostrich. It is trickier than a balky mule and can kick twice as hard. Such a combination naturally makes a pet ostrich only another name for suicide.

But baby ostriches are cute. They are round and plump and covered with the dearest feathers resembling narrow bands of different colored material. The chick's head and neck appear to be covered with a sort of natural plush striped like a tiger's skin. The baby ostriches are always great pets in regions where these animals thrive either in a natural state or on some of the big farms where they are raised for the sake of their plumage.