Correspondence.

SIR ISAAC NEWTON AND THE APPLE.

To the Editor of the SCIENTIFIC AMERICAN:

In yours of August 22, 1908, you mention an oft-told story about the law of gravitation. I think we all have eyes to see apples fall to the ground, but Sir Isaac had eyes backed up by such a grand brain that he first saw the ground fall to the apple. LAWR. HARGRAVE.

Woollahra Point, Sydney, October 5, 1908.

GEAR-DRIVEN PROPELLERS FOR AEROPLANES.

To the Editor of the SCIENTIFIC AMERICAN:

I should like to call your attention to the defective application of power in the Wrights' aeroplane. I have just read of Wilbur Wright's saving himself from an accident which might have been as serious as Orville Wright's. This should be conclusive proof that chains should be discarded for more positive drive, using gears. Chains cannot be made which can absolutely be depended on not to break, and they do break on automobiles and other pieces of machinery. As Wright has ample power and extra weight would not be an objection, there seems no reason for his not using gear-driven propellers. This would make riding in the aeroplane fifty per cent more secure. Through your columns, which have given such valuable advice to inventors, will you not suggest some such change?

FRANCIS LEE HERRESHOFF.

New York, N. Y., November 19, 1908.

THAT MYSTERIOUS AEROLITE.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of November 28, 1908, under the heading, "The Mysterious Aerolite," Mr. E. B. Hoyte suggests that the explosion heard by Mr. Park Marshall on September 8, at about 10 A. M., was caused by the exploding of a shipment of dynamite, and not by a possible meteor.

That may be the solution of the disturbance, but I think it an interesting coincidence that on September 8 at about 10 A. M., while walking along a street of Winchester, Franklin County, Tenn., I suddenly looked up at the sky, and saw what seemed to be a pyramid of yellowish white flame, on its side, going through the air at a tremendous rate, with the base end foremost. It was as brilliant as the sun at noon on a clear day, but it did not blind my eyes. It seemed to be about three yards long from base to top, and exceedingly high up in the sky. I scarcely had time to see it before it was out of sight. It was going in a northwesterly direction at an unprecedentedly rapid rate.

I immediately told of what I had seen, and had just finished the account when I heard what I at first thought to be thunder out of a clear sky; but when the noise continued to roar and rumble, and cause a slight vibration of the ground, I thought there had been an explosion somewhere. It was not until all explosion theories had been proved false in the vicinity of Winchester, that I connected the noise with what I had seen.

Whether the two had anything to do with each other, I do not know. But the object in the sky and the sound of an explosion have never been satisfactorily explained to my knowledge. A. M. BUTTON.

Waterford, N. Y., November 28, 1908.

THE FLORIDA INLAND CANAL.

To the Editor of the SCIENTIFIC AMERICAN:

Kindly permit me to say a word through your great paper on the subject of an inland canal through the great State of Florida.

I gave twenty-four years of the best days of my life and broke down from overwork, in aiding in the development of Florida. The last work that I did before leaving the State was the completion of surveys to determine the extent of the great bodies of muck land from one foot to six feet under water, along the east coast of Florida, and to see if those lands could be reclaimed, which when reclaimed would constitute a portion, and a large portion, of the richest sugar, rice, vegetable, and tropical fruit lands in the world. Working in co-operation with the great Diston effort to reclaim the muck lands in the Kissimmee Valley and to lower the waters of Lake Okeechobee, which is only nine feet on its surface at low water above sea level.

We discovered by joining these surveys at the headwaters of the St. Johns River with those of the surveys by Mr. Diston from the headwaters of the Kissimmee River, that a ship canal on the sea level carrying a depth of twenty feet of water could be cut, giving a canal almost the length of Florida, by utilizing the St. Johns River, running nearly a hundred miles due north to Jacksonville before it enters the Atlantic Ocean, and by utilizing the lower Kissimmee River and Lake Okeechobee and Lake Hickpochee and the Calachasee River for nearly another hundred miles to enter the Gulf, thus saving millions of acres of some of the richest land on earth on both sides of a canal nearly three hundred miles long, that can be constructed for twenty-five million dollars and insure the drainage of the larger portion of the Everglades without additional expense.

It was by accident or a coincidence of ultimate results that the sea-level route was found. We were planning to open the headwaters of the St. Johns River from near the south end of Lake Washington into the Indian River, the surface of Lake Washington being about twenty feet above Indian River, and the St. Johns at Jacksonville being about ten feet below the surface of Lake Washington.

Noting the peculiarity of the river running nearly on an air line over a hundred miles north, started us to taking a system of levels at its fountain head, and we found that the St. Lucy River found its headwaters in the same lake, running to the Atlantic Ocean in a southeast direction.

By checking up these levels, we found that if we cut a canal through to the Indian River from this lake, we would damage navigation on the upper yet lower St. Johns River.

We found in running lines of level from the south end of Lake Washington to the Kissimmee River to strike the line of the Diston canal for Lake Okeechobee, that the Alpataka Flats was the drainage and dividing line between the east coast and the west coast of south Florida, and that the lowest point across was not exceeding fifteen feet above sea level and only a few miles wide.

Mr. Diston had already opened a canal for small boats through from Kissimmee by way of Lake Okeechobee, Lake Hickpochee, and the Calachasee River to the Gulf, and had run level lines the entire distance. Hence it was only a matter of comparing my east coast survey with his midland and west coast survey, and thus we found the long-looked-for canal route on a sea level that could be made available for ocean-going ships as well as for drainage; and found out also that without lowering the great lake to the sea level it would be practically impossible to drain any great portion of the Everglades, or to keep the water in the Kissimmee Valley from backing up and overflowing the drained lands during extra heavy rainy seasons.

So astonishing was the simplicity of the construction of this canal, that would save and reclaim enough land to produce the sugar and rice consumption for fifty years in America at three cents a pound for sugar at a good profit, and yet so stupendous was the vast field opened for local and national benefit by the construction of this canal, that it startled us; for the hope of a sea-level canal across Florida from the Gulf to the Atlantic had been abandoned years ago after numerous surveys.

This work should now be coupled with the great Inland Waterways Proposition for the canal from Lake Michigan at Chicago to the Mississippi River; and when the two are completed, no ordinary mind can grasp the world-wide benefits that will result from their construction.

On the discovery of the possibility of a sea-level canal that would accomplish this great double purpose, we planned with Mr. Diston to join our work and ask Congress to dig this canal, as it would not only save millions of acres of the richest land on earth, it would give the Gulf of Mexico an inlet and outlet to the Atlantic Ocean and to the eastern world without ships having to pass out of the Gulf over the dangerous reefs, or around Cape Florida over the most dangerous reefs known to American commerce. With the canal from Chicago to the Mississippi, boats both from the East and the West could go down and back through the Caribbean Sea, around the end of Cuba, and out through the Panama canal to the Pacific Ocean, missing nearly all of the most dangerous voyage known to American commerce. S. A. JONES.

Waynesville, N. C., November 8, 1908.

PROGRESS ON THE PANAMA CANAL.

A review of the reports of the Isthmian Canal Commission for the fiscal year ended June 30, 1908, shows that most satisfactory progress is being made, the results in excavation exceeding the most sanguine estimates of progress. In order to concentrate authority, to expedite the transaction of business, to secure proper co-ordination, to fix definitely the responsibility in any particular case, and to reduce the cost of administration, a complete reorganization was undertaken toward the close of the fiscal year, to be effected gradually, beginning July 1, by which all construction work, in any given district, irrespective of its character, would be placed under one head, the necessary authority having been received from the Secretary of War for the transfer of duties as between departments, required by executive order of January 6, 1908.

To accomplish the objects sought, the zone was divided into three parts, each of which is to constitute a division under the department of construction and engineering, the division engineers reporting direct to the chief engineer. The first is to include all territory north of Tabernilla, to be designated the Atlantic division; the second is to extend from Tabernilla to Pedro Miguel, to be named the central division; and the third, extending from Pedro Miguel to deep water in the Pacific, will constitute the Pacific division. As the reorganization is not complete at this time, its details must be left for the next annual report.

EXCAVATION AND DREDGING.

This department embraced the Culebra division, the Chagres division, the Colon dredging division, and the La Boca dredging division.

Culebra division.—This division extended from the Chagres River in the vicinity of Gamboa to include the Pedro Miguel lock, a distance of 9.2 miles; the total amount of material excavated in the Culebra division during the year was 12,065,138 cubic yards, place measurement, of which 11,685,253 cubic yards were from the canal prism and the balance for accessory work. The total number of steam shovels assigned to this part of the work during the year was 59.

As practically all the areas suitable for dumps within the limits of the division were utilized to their fullest capacities, the greater part of the material was hauled over the main line of the Panama Railroad to Gorgona and Tabernilla on the north and to the new dumps at Miraflores and La Boca on the south, the average haul being about 10 miles.

On October 4 the Cucaracha slide, which had caused more or less inconvenience since the work was begun by the French in 1884, started to move toward the east edge of the canal at a rate, at first, of 14 feet in twenty-four hours, decreasing toward the close of the month to about 4 feet in the same period of time. About 113,000 cubic yards of material moved so as to effectually stop the transportation of material through the "cut" to the south, and necessitated the handling of all material over the single-track portion of the Panama Railroad via Empire to the south. Work was prosecuted, without interruption, day and night, by steam shovels and improvised hydraulic means, and by the end of the month sufficient space was gained on the moving mass to permit the passage of dirt trains to the south over the old route. The total area of the slide was approximately 34,455 square yards, and it was estimated that about 600,000 cubic yards were in motion. The removal of this slide is not a source of difficulty in the dry season. A wide berm was left with the hope that should rapid movement again take place, steam shovels could prevent the interruption of traffic.

The slide at Paraiso, another which developed when the French were at work on the canal, gave trouble in April of this year. The estimated area is 16,700 square yards, and the amount in motion is about 140,000 cubic yards, of which about 90,000 cubic yards have been removed.

Chagres division.—This division covered a distance of about 23 miles and extended from Gatun to a point where the canal crosses the Chagres River at Gamboa. The river crosses the canal line 23 times within the limits of this division, so that during construction a considerable portion of the prism is subject to overflow by floods, and to such an extent that progress of work is liable to be slow during the rainy seasons.

The surveys reported as in progress in the last annual report were completed, and the center line of the canal permanently marked. Slight changes in the alignment were made in the final location whereby a saving of 1,264,700 cubic yards was effected; of this, 264,300 cubic yards were rock. These surveys show that the total amount to be removed from this part of the canal prism is 12,256,300 cubic yards, of which 8,313,500 cubic yards are earth and the balance rock. During the fiscal year excavation was begun on four different sections. The total amount of material excavated was 1,774,124 cubic yards, place measurement, all from the canal prism. The total number of steam shovels in operation in this division was 15 and the balance of the equipment is largely that left by the French; 47 out of a total of 50 engines in use are French, as are 410 of the 645 dump cars.

Colon dredging division.—This division extended from the foot of Gatun lock to deep water in the Caribbean Sea, and embraced the Mindi and Colon districts and the Cristobal machine shops. Excavation by steam shovels was begun in July, and two of them removed a total of 536,959 cubic yards, including both swamp and rock. Dredging during the year was done by two French ladder dredges, two dipper dredges, the 16-inch suction dredge, and by the seagoing suction dredge "Ancon." A total of 5,087,623 cubic yards of material was removed, of which 4,947,330 cubic yards were from the canal prism and the remainder from accessory works.

La Boca dredging division.—The change in the location of the locks and dams on the Pacific side extended the limits of this division about 3 miles, the area to be dredged extending from the Miraflores locks to deep water in the Pacific, a distance of about 8 miles, with a width of 500 feet. The quantity of material to be removed is estimated at 29,212,700 cubic yards, at least 1,500,000 cubic yards of which is rock. There have been used on this stretch of the canal the seagoing suction dredge "Culebra," which went into commission on January 1, and four French ladder dredges. The dipper dredge was taken out of commission on January 17, 1908, as not suitable for handling the soft material, and will be utilized later in the removal of rock. During the fiscal year a total of 5,273,369 cubic yards was removed, of which 5,264,019 cubic yards were from the canal prism and 9,350 cubic yards from accessory works.

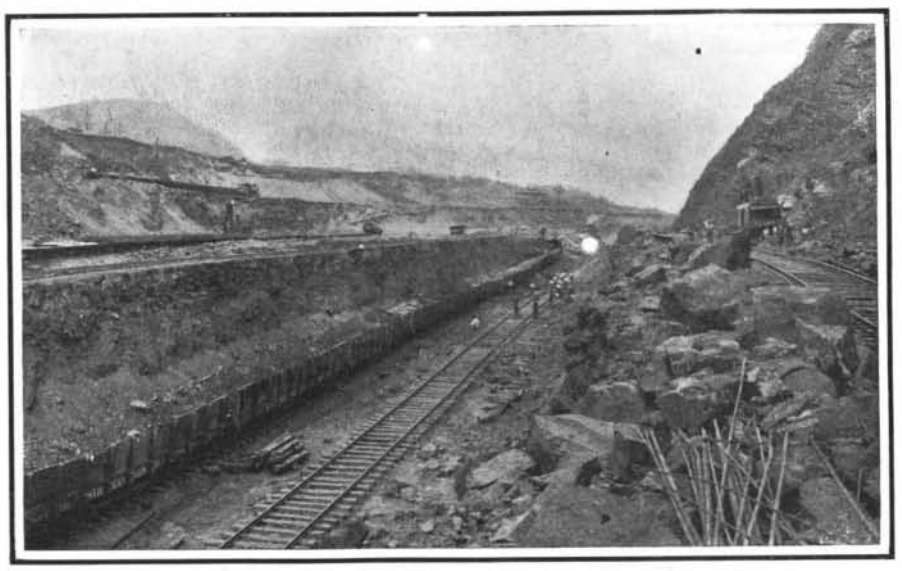
LOCKS AND DAMS.

This department of construction embraced the Gatun locks and the Gatun dam divisions, the Pacific division of locks and dams, and the division of meteorology and river hydraulics.

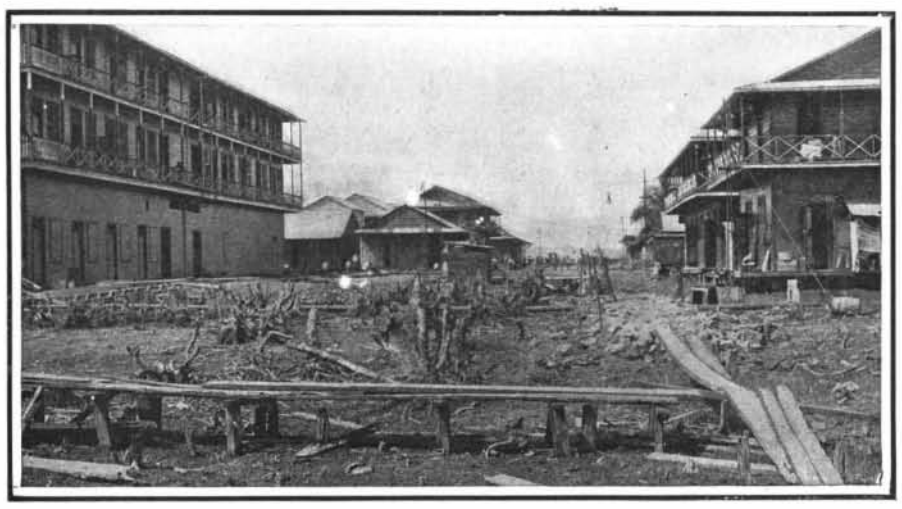
The locks are in pairs, and since the compilation of the last annual report the projected dimensions have been increased so that the width in the clear will be 110 feet, the usable length remaining, as heretofore, 1,000 feet. The question of increasing the width was raised by the General Board of the Navy, in a memorandum to the Secretary of the Navy, dated Washington, October 29, 1907, setting forth "that the width of the locks as now fixed, namely, 100 feet, is insufficient for probable ships of future construction, and that sound policy would dictate an increase to a clear width of 110 feet."

The project prepared by the minority members of the board of consulting engineers for the lock type of canal provided for a flight of three locks at Gatun, a flight of two locks at La Boca, and one at Pedro Miguel. The locks at La Boca were placed on the west side of Sosa Hill, and were to overcome the difference of the level between the ocean and a lake formed by the Sosa-Corozal and the Sosa-San Juan dams. Steps were taken to construct the former of these dams in accordance with the proposed plan, and

Culebra cut, looking south.



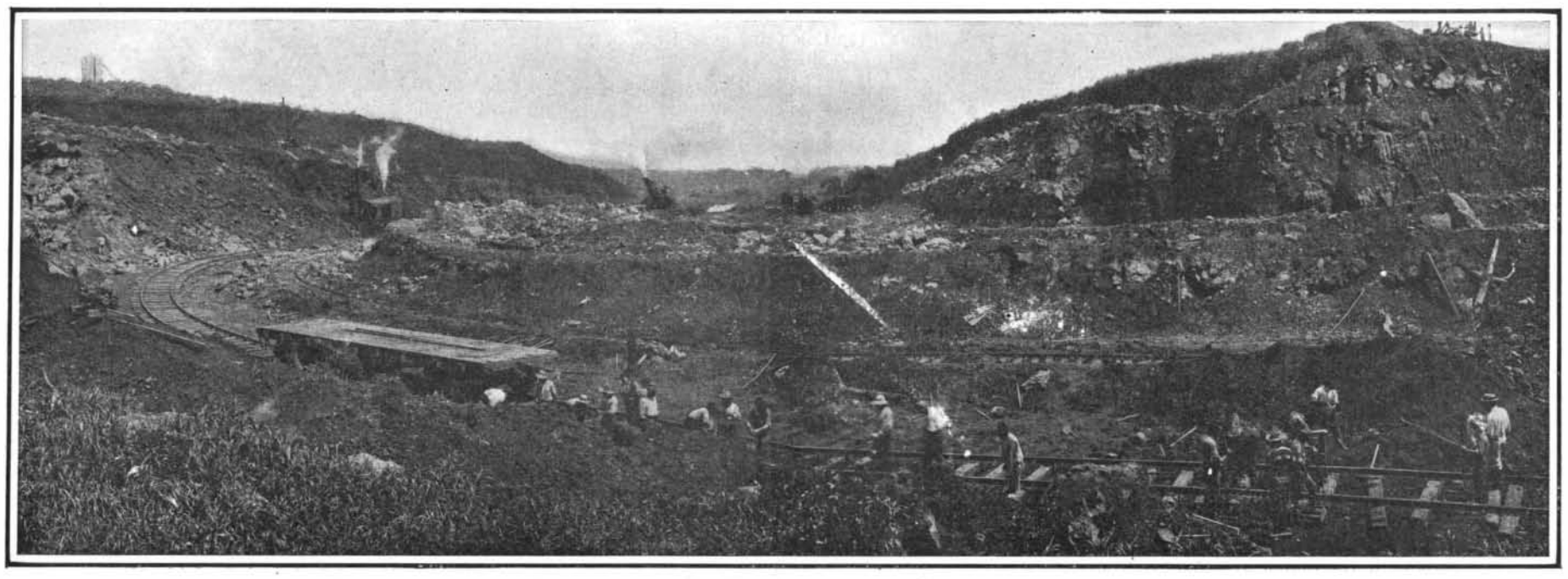
The steam shovels load directly into trains which are hauled to distant dumps.



Tenth Street, Colon, before paving.

Tenth Street, Colon, after paving.

Pedro Miguel lock site.



Excavating for the spillway on the center of Gatun dam.

PROGRESS OF THE PANAMA CANAL.

trestles were built along the toes from which to dump material from Culebra cut. The trestles failed after the dumping from them began, and the material overlying the rock moved laterally, carrying the superimposed mass with it. When the unsuitable nature of the ground became evident, a careful examination of the canal route from Pedro Miguel to the Pacific was undertaken, and a study of the data thus obtained led to the conclusion that one lock at Pedro Miguel and two at Miraflores offered the most economical and desirable solution. The advantages of this plan over the then existing project were that dams of lower height, less length, and resting on rock comparatively near the surface could be more easily constructed and could be completed at an earlier date; and finally that the locks in this location would be protected against all possibility of distant bombardment and would be less exposed to gunboat or torpedo boat attack. As a consequence, the commission recommended a change in the project, which received the approval of the President on December 19, 1907.

The designs for the locks are still in course of preparation, but the studies have reached such a stage that the general features will be definitely determined at an early date.

Gatun locks.—Investigations were continued during the year to ascertain the depths of the underlying strata and to determine also whether suitable material extended sufficiently far below the level on which the lock walls are to be built to carry the weight; a depth of 50 feet below this level was fixed and the borings were so made. The materials encountered may be briefly summarized as a layer of argillaceous sandstone, overlying a layer of conglomerate which is composed of pebbles and other hard aggregates held together by a cementing material, and which subsequent excavation shows to be hard enough in texture to require blasting for its removal. The borings disclosed an underground flow through the sandstone, the source of supply being apparently ground water from the hills to the southeast and at a considerably higher elevation than the lock site. It is intended now to prevent access to the foundation of this water by means of curtain walls connected with the underlying impervious stratum of argillaceous sandstone, and additional precautions will be taken if developments during construction make such advisable or necessary.

The excavation for the locks was continued throughout the year,. The total amount removed from the site was 1,769,115 cubic yards.

Gatun dam.—Investigations, primarily undertaken to verify data already on hand concerning the character of material for the foundation of the dam, were continued. A test pit, 12 feet square, was sunk in the hill through which the spillway is being cut and near its head, and this has been carried down to about 35 feet below sea level. The rock formation here is practically the same as that at the lock site. On Gatun Island a test pit 20 feet square was sunk to a depth of 68 feet below sea level. Wash borings were resorted to, but care was taken to secure drive samples whenever there were indications of any change in the character of the material.

The examinations made of the spillway indicate that the rock is of sufficient strength to bear safely any of the loads that will be placed upon it. What seepage there is occurs in the top stratum; and though this is small, it is proposed to cut it off by sheet piling projecting up into the core of the dam and down into the impervious layer.

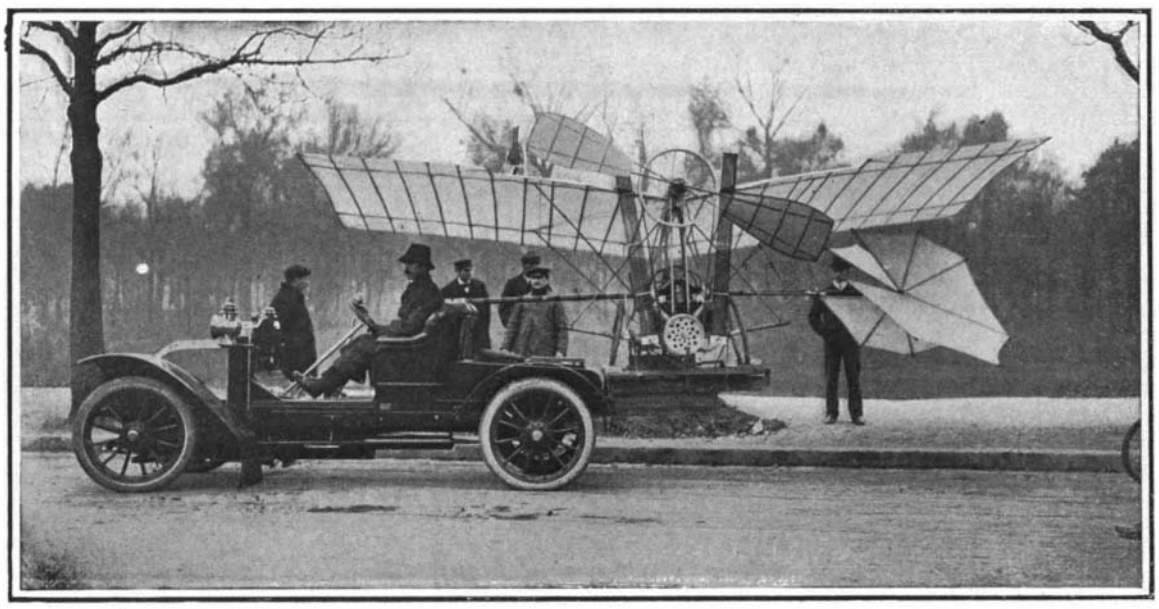
Two experimental dams, with dimensions corresponding to the dam as it is to be built, were made on the scale of 1 inch to the foot, and these experiments show not only the suitability of the available material, but that a stable and water-tight dam can be built by hydraulic methods. Construction work at the dam during the year consisted in the removal of 918,920 cubic yards of material from the spillway.

Pedro Miguel.—As it was more advisable and economical, the Culebra division excavated the lock site down to reference 40, practically completing it to this grade at the close of the fiscal year, and removed 1,071,696 cubic yards, which amount is included in the total yardage under Culebra division.

Miraflores locks and dams.—It is shown conclusively by test pits and borings that the locks will rest on rock of ample strength to make suitable foundations. A hard limestone is found for the upper part of the site, changing to argillaceous sandstone at the lower end. The borings disclosed no such variations in the formation as exist at Gatun.

Municipal engineering.—The work of this division consisted of the completion of the waterworks, sewerage system, and paving in Panama and Colon, the cost of which is to be reimbursed to the United States through the collection of water rates in those cities, and of the construction of waterworks and sewerage systems, paving, grading, and road making in the Canal Zone. The total cost of the work done was $1,067,150.52.

Work in Panama and Colon, as originally planned, is practically completed.



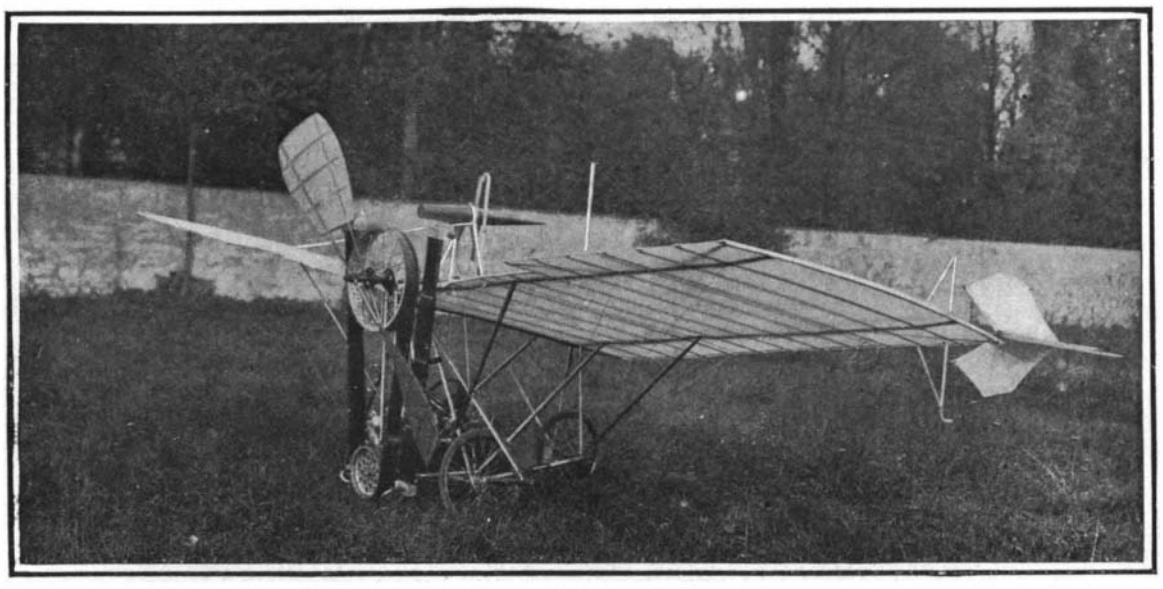
Santos Dumont transporting his new monoplane on his automobile from Paris to his experimental field at St. Cyr.

This miniature aeroplane complete with its 24 horse-power motor weighs only 297 pounds. A speed of about 36 miles an hour must be attained with it on the ground before it will rise in the air.

SANTOS DUMONT'S LATEST AEROPLANE.

The tiny aeroplane illustrated on this page is the latest one to be produced by Santos Dumont. The noted Brazilian experimenter has not been actively engaged in continuing his experiments in aviation for the past few months, but he has now taken up the subject again, and has brought out once more the tiny aeroplane with which he made some experiments last spring.

To give his monoplane good transverse stability, Santos Dumont has placed the two wings at a slight dihedral angle and has located his seat and the motor about 3 feet below. This brings the center of gravity well below the line of support. The propeller, which is mounted upon a hollow steel shaft running in ball bearings, is placed at the front edge of the plane at the center. It is about 6 feet in diameter, with a 6½-foot pitch, and runs at a speed of 700 R. P. M. The machine as it now stands has a 24-horse-power 8-cylinder Antoinette motor, arranged on a 3-wheeled running gear. The motor drives the propeller by a wide belt. A speed reduction of about one-half is arranged for from the motor to the propeller. The normal speed of the motor is 1,300 R. P. M. Its weight complete is 127.6 pounds. A seat is provided just back of the motor for the aviator, who controls the combined vertical and horizontal rear rudder by means of a vertical wheel placed beside the motor. The entire machine complete in running order weighs only 297 pounds. The spread of the wings is but 5 meters (16.4 feet), the dimensions of each wing being 2.5 x 2.1 meters. The total supporting surface is only 10.5 square meters (113.02 square feet). A speed of about 36 miles an hour must be developed upon the ground before the machine will rise in the air.



The 24-horse-power, 8-cylinder motor drives the large propeller by means of a belt. The motor is mounted upon a 3-wheeled running gear and the aviator's seat is immediately behind it. Note the long vertical radiators on each side of the propeller, the gasoline tank above the wings, and the combined vertical and horizontal tail at the rear.

SANTOS DUMONT'S LATEST MONOPLANE, THE "DEMOISELLE."

This reconstructed monoplane is by far the lightest and most powerful machine of its kind that has ever been produced. With Santos Dumont in the aviator's seat the total weight to be lifted is about 411 pounds, which gives a loading of the single surface of 4 pounds per square foot. This is about the highest ratio of weight to surface that has ever been employed.

On the 12th ultimo M. Dumont tried his new monoplane (which he has christened "Demoiselle") at St. Cyr. A number of short flights were made, no particular difficulty being experienced in getting up in the air. One of these flights terminated rather suddenly, with the result that one of the wheels buckled.

On account of the small size of his monoplane, Santos Dumont was able to carry it from Paris to St. Cyr on the rear of an automobile, as is shown in one of our illustrations. This is the first time, so far as we know, that an automobile has been used for transporting an assembled aeroplane from the city to a suitable place in the country, where the aviator can conduct his experiments.

THE FOURTH AEROPLANE OF THE AERIAL EXPERIMENT ASSOCIATION.

The photographs reproduced herewith show the latest aeroplane—"The Silver Dart"—of the Aerial Experiment Association, and also the third, or "June Bug," aeroplane, which has been remodeled and mounted upon pontoons for experiments upon the water.

The fourth aeroplane which the association has constructed has the same general lines as the "June Bug," which preceded it. Some modifications, however, have been made in the curve of the surfaces and in their size and spacing, while the new machine has no tail whatever, since the later experiments with the "June Bug" showed this to be unnecessary.

While the ribs of the former aeroplanes had a reverse curve at the rear (which form of curve the experiments of W. R. Turnbull demonstrated to be the most efficient), it was thought that the upward pressure of the air upon the flexible rear edges of the planes made this reverse curve too pronounced, and tended to check the forward motion of the aeroplane. Consequently, the ribs of the new machine have only a single curvature, and it is believed that the air pressure upon the rear edges of the planes will automatically produce the slight upward curvature at this point. The width of the planes from front to back at the center has been reduced from 6½ to 6 feet, and the spacing apart of the planes also has been reduced to this figure. The width of the planes at their outer