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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles short, and the facts authentic, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

ENGINEERS REPORT IN FAVOR OF LOCK CANAL.

In the course of his message to Congress accompanying the report of the engineers who inspected the Panama Canal with President-elect Taft, President Roosevelt hit the nail squarely on the head when he stated that any criticism on the present lock plan "is merely an attack on the policy of building any canal at all."

The President's statement is literally true, for the experience already gained in building the very much less costly lock canal proves that the cost of a sea-level canal would be prohibitive. The estimate of the Taft Board of Engineers places the total cost of the lock canal at \$360,000,000. Some of this increased cost is due to improvements and enlargements of the original plan, and much of it to the steadily increasing cost of labor and material. To complete the canal at sea level would take, we believe, nearly twice as long as to complete it on the present plan. It is likely that the cost of labor and material will continue to increase as the years go by; and the greater length of time, coupled with this ever-increasing labor and materials expense, would bring the cost of the sea-level type up to at least \$500,000,000. It is an open secret that the compelling motive in the construction of this work is the possibility of an acute crisis in the world politics of the Pacific Ocean and the Far East. So swiftly do matters move in this present age, that an international crisis of the first magnitude might easily have arrived and passed, long before the ten years necessary to complete a sea-level canal had gone by.

Furthermore, a sea-level canal carrying a bottom width of only 200 feet for the greater part of its length, would be impossible of safe navigation by the ships of the future, which, many of them, will be not less than 900 feet in length by 110 feet in beam. This would leave but 40 feet of clearance between the ship and the side of the canal; and should a vessel of this length take a sudden sheer in the four or five knot current which would prevail at certain times, due to the 10 feet difference of level of the oceans at each end of the canal, she would be into the bank before she could be controlled. The lock canal will have but $4\frac{3}{4}$ miles of narrow channel (a sea-level canal would have 40 miles), and for 20 to 30 miles of its length, the ships will be traveling in channels from 500 to 1,000 feet wide and from 45 to 75 feet deep. Because of the higher speed possible in the deeper channels, it will take less time to traverse the lock canal.

The report of the engineers, all of whom are specialists of high reputation in hydraulic work, is a unanimous and unusually strong indorsement of the present lock canal in every feature of its construction. Indeed, the report goes so far as to state that greater caution has been exercised than is strictly necessary, and it suggests lowering the crest of the dam by 20 feet, or from 50 to 30 feet above the level of the water against the dam. The engineers also favor increasing the minimum width at the bottom of the canal for a distance of 4.7 miles through the Culebra cut. In the opinion of the Board, "the work is well organized and is being energetically conducted," and they "see no reason why the canal should not be completed by January 1st, 1915."

DOUBLE-SIDE-DOOR TRAINS ON THE SUBWAY.

The Public Service Commission and the traveling public are to be congratulated on the success attending the use of the double-side-door, experimental train, which has been put in service on the New York Sub-

way. The change, which was made on a regular eight-car express train made up of standard equipment, consists in placing at each end of the car an additional door, located about one door's width from the existing platform door. The new door is operated by pneumatic power, and, when opened, slides into a pocket between itself and the adjoining end door. The extra doors are used by the outgoing passengers, and the old doors by those that board the train. The object of the arrangement is twofold: first, to double the total area of doorway entrances, and secondly, to secure a free circulation by separating the streams of outgoing and incoming passengers.

The placing of this train in service is one of several changes ordered by the Public Service Commission on the advice of its consulting engineer, Mr. Bion J. Arnold, for the purpose of accelerating the movement of trains, and thereby increasing the carrying capacity of the system. With the existing cars, all the outgoing passengers must leave the car before the incoming passengers are admitted. With the new cars, the discharging and receiving of passengers goes on simultaneously. This, of course, means a considerable saving of time; and Mr. Arnold estimates that it will result in increasing the carrying capacity of the whole Subway by twelve per cent. As the Subway has carried on holidays as many as 800,000 passengers in a single day, this would mean an increased carrying capacity of nearly 100,000 people. The total cost of changing all the cars of the road would be about \$1,000,000—a very reasonable outlay for such a large increase in capacity.

Unfortunately, the Interborough Company fails to regard the proposed improvement in this light; and the early days of the operation of the trial train seem to have been marked by no little friction between the company's officials and the expert of the Public Service Commission who was placed in charge of the train. The company has raised various objections, claiming that the guards are unable to see the new doors, a difficulty which could easily be met by having special platform attendants to assist in their opening and closing at the proper moment. The company also seems to consider that it would be better to use both doors for incoming and outgoing passengers, instead of segregating the passengers in the manner recommended by the Commission. These, however, are questions of mere detail of operation. The fact remains that on this experimental train the total exit and entrance area has been doubled; the movement of passengers greatly accelerated; and the time of station stops cut in half. "Where there's a will there's a way." The Public Service Commission and the New York traveling public have found the way, and it will be to the interest of the operating company to do everything in its power to promote an improvement of such obvious necessity and importance.

CONSOLIDATION OF THE NAVAL BUREAUS.

The recent attack upon our navy was made along two lines; one aimed at the ships, the other at the organization of the yards at which the ships are built. The SCIENTIFIC AMERICAN, as far as it has engaged in this controversy, has hitherto directed its attention to the defense of our ships, as being the more important element of the controversy. To-day there is no doubt that the public at large, and its representatives in Congress, are satisfied that our ships are at least as good as any that float, and that in the building and manning of a navy we are abreast of the world.

As regards the other question, that of naval administration, we are with the critics in believing that it can be greatly improved by a consolidation of the several bureaus, but we are against them in their proposal that the administration of the bureaus as thus consolidated be placed under a board consisting exclusively of seagoing officers. We believe that the work of designing and equipping our ships should be under the exclusive control of staff officers, carefully trained for this highly specialized and very difficult work; and that in the preparation of the designs, the constructing staff should act in collaboration with the line or seagoing officers to the extent of asking for, and carefully considering all suggestions—and there will be many of them—based upon the experiences of these officers when in command of the ships.

In looking through the literature that has appeared during the past few years upon the subject of consolidation, we find that the most comprehensive, practical, and convincing paper is one written by Naval Constructor T. G. Roberts in 1904, and published in the Proceedings of the United States Naval Institute of June, 1905. The present condition as outlined by Mr. Roberts is as follows: The work of the navy yards is done under seven separate bureaus, comprising the Departments of Construction and Repair, Steam Engineering, Equipment, Yards and Docks, Ordnance, Supplies and Accounts, and Medicine and Surgery. The Bureau of Navigation is represented by the commandant of the yard. This division of work is a development of the conditions that existed when war-

ships were built of wood and propelled by sail power. But under the readjustment which followed the introduction of steel and steam into the navy, the bureaus became multiplied and overlapped; so that, to give a concrete instance, the Department of Steam Engineering owns the steam pipes and pumps and engines belonging to the Construction Department; while the Department of Equipment owns the dynamos and the dynamo foundations, if there are any, and the railing around them if it is attached to these foundations. Shipbuilding was originally made up of several professions; but to-day it has merged into a single profession, and it not only includes the production of the whole ship, but it operates the shipbuilding plant, by which it controls the profit which forms the measure of efficiency in industrial administration.

The remedy is the simplest business proposition of this country—consolidation. In a certain navy yard on the Atlantic coast, there are distributed among the various bureaus some seventy shops; thirty-two storehouses under separate roofs; fifty separate piles of materials, and thirteen coal sheds and bins under separate roofs. Included in the seventy shops there are six separate power plants; eight separate machine shops; five separate joiner shops, etc. Corresponding to this outfit are separate sets of foremen, clerks, and draftsmen in each department, aggregating seventy-five foremen, eight clerks, and thirty-six draftsmen. As a matter of fact, there is no necessity for more than one shop of each class and kind, as is proved by the practice of the private shipyards.

The reorganization proposed by Mr. Roberts would combine the Bureaus of Construction and Repair, Steam Engineering, Equipment, and Yards and Docks, under the heading of a new bureau called the Bureau of Naval Construction. The Bureau of Ordnance should remain as now, excepting that its duties should end with the manufacture of ordnance and its shipment to the shipbuilding yard. The bureaus not affected by the consolidation would be those of Supplies and Accounts, and Medicine and Surgery.

"The present necessity," says Mr. Roberts, "is the unification of navy yard industry so that it cannot duplicate itself, and so that naval industrial administration may operate in the full benefit of modern methods as developed with such success in the private industries of this country. All power plants, shops, heads of departments, assistants, draftsmen, clerks, etc., may be combined into one set of each class or kind. The result would effect a reduction of the number of buildings in use, the working forces, and the total cost of the establishment by an amount that would be startling to predict."

The evils of the present system as depicted by this officer, after five years' consecutive experience of them at a particular yard, furnish most interesting reading. The unsystematic method of laying out new yard plants results in an enormous unnecessary expense, due to rehandling and long hauls of material; and a great source of loss lies in the lack of harmony which usually exists between heads of departments. One department owns a crane, a second department is using it, while a third department waits for it. A load of steel plates arrives at a yard, and is removed by one department; another department, which has the list of plates, retains it sometimes for a week or two. When the list arrives, a third department has to inspect them. The first department does not find it convenient to handle the plates until the broken crane of the fourth department is mended. At the end of some months the inspection is completed, and the contractor has lost several months' interest on his money. A drydock and its power plant belong to one department; the operation of the power plant belongs to a second department. Instances of this kind can be multiplied.

Since the designing of a ship is purely a technical-constructive work, Mr. Roberts believes, and we heartily agree with him, that the various bureaus should answer directly to the Secretary of the Navy. To interpose between the Secretary and the constructive staff a "general staff," composed purely of military administrators, whose education, training, and experience has been almost entirely in the operation and control of the ships as built, would be a serious mistake, and tend to reproduce, to some extent, the very evils which consolidation attempts to overcome. Since the Bureau of Construction, even under present conditions, controls one-half of the force and equipment of the navy yards, and under the consolidation, as here set forth, would control over four-fifths, it seems to us that if the consolidated bureaus are to be represented by a single head, answerable directly to the Secretary of the Navy, the officer selected should be the Chief Naval Constructor.

That ballooning is more or less dangerous after all, has again been shown by the dashing of a balloon against some rocks, when the aeronauts were attempting to land, which occurred in France on the 2nd instant, and as a result of which the two men were killed.