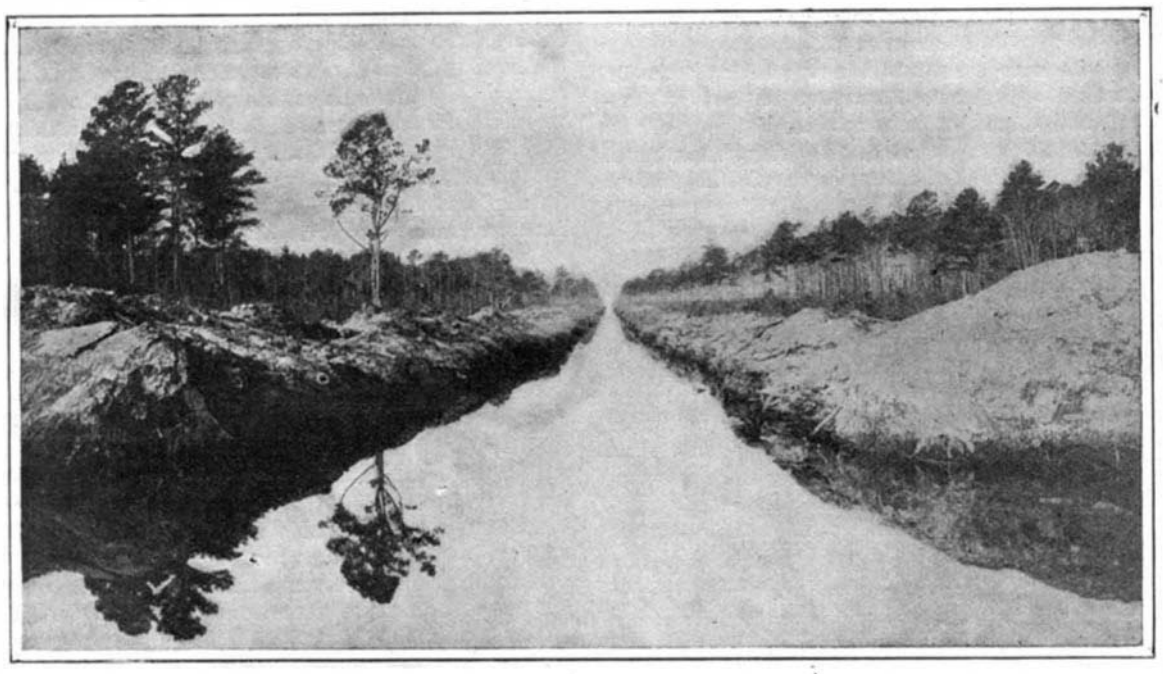
THE NORTH CAROLINA-VIRGINIA INLAND WATERWAY.

BY H. L. WILSON.

The Congress which recently adjourned passed one of the most important, if not one of the largest, rivers and harbors bills in recent history. Among other things it provided recognition of the North Carolina-Virginia inland waterway, which has been before the public for some seven years, and for which surveys were authorized in the rivers and harbors acts of 1902 and 1905.



Abandoned Cutting on Route of Canal, Showing Character of Country.

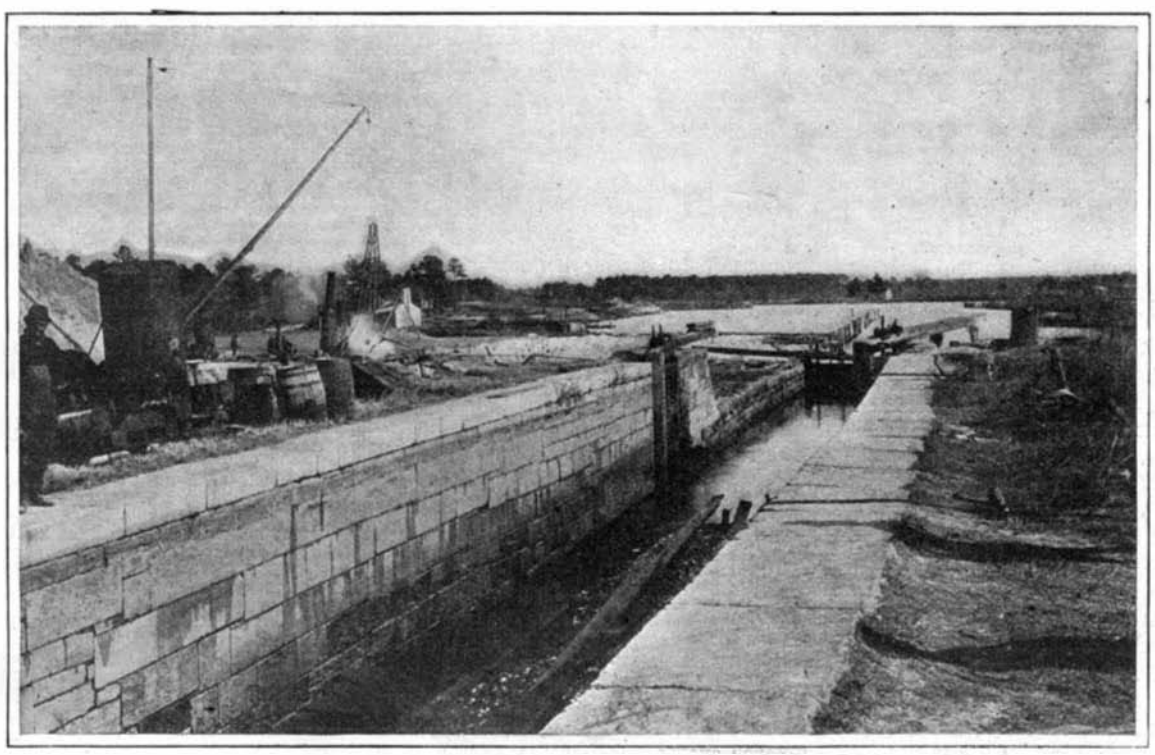
The reports of the engineers making these surveys considered carefully all available routes, and decided that two were so nearly equal in advantages and disadvantages that the monetary consideration alone should form the deciding factor. These two routes are known as the Albemarle and Chesapeake canal and the Cooper Creek routes respectively, the former contemplating the purchase of the already existing Albemarle and Chesapeake canal, which connects Chesapeake Bay *via* Elizabeth River with Currituck Sound; and the latter neglecting the purchase of that canal and digging a new one from Elizabeth River to Cooper Creek, a branch of the Pasquotank River, which is an arm of Albemarle Sound. With the purchase price of the already existing Albemarle and Chesapeake canal at a figure not exceeding $500,000, the former is recommended. If the price asked is higher, the latter route is recommended. While no expression of opinion which is in any way official can be obtained from the canal company, it seems to be the general impression that the amount named is sufficient to make the purchase assured.

The objection which has always been urged against the construction of this waterway is that it is a purely local measure, benefiting people of a comparatively small section. Its friends, however, vigorously combat this view, and bring forth in substantiation of their claims a number of facts and statements which are worthy of consideration. There is no doubt of the fact that coast trade, as far as low-price freight is concerned, is practically a non-existent factor in southern transportation, because of the terrible dangers of Cape Hatteras, the "Deadly Diamond" as the shoal is known, and the famous Hatteras "saw teeth," which supply the victims for the "Graveyard of the Atlantic." Small boats, barges, and lighters carrying freight simply do not attempt the outside passage, ten months in the year, on account of the difficulty of rounding the Cape and the danger of going ashore on the shoal, with a total loss of property and an almost equally certain total loss of life. The opening of the inland waterway will completely circumvent these dangers, as a glance at the map will make evident, allowing a complete inland passage to be made from Chesapeake Bay to and through Beaufort Inlet, below both Capes Hatteras and Lookout.

Canal Connections with Natural Bodies of Water Will be Frequent, Where the Canal Enters a Small Lake, as Shown in This Photograph.

Commercial organizations throughout the South have indorsed the measure, and the southern delegations have stood for it in a solid mass, but until this last Congress it has always been throttled in committee. This time, however, in spite of the opposition of Chairman Burton, the appropriation was made. Unfortunately, the appropriation considers only a 10-foot depth of the canal, in the face of the emphatic reports of the engineers that a 12-foot canal was what was wanted and a 10-foot canal totally inadequate to the needs of those who will use it. The reason is plain. The most economical barge, of moderate size, is the barge with a 10-foot draft. That is, considering first cost, insurance, carrying capacity, speed, and towage charges, a barge of 10 feet draft pays better than one of 8 or one of 12. Consequently, a 12-foot canal and sound dredging was indicated—Congress provides a 10-foot waterway. It is pointed out that a 10-foot canal really means nearly 12 feet, as more is always excavated rather than less. It is also easily seen that in future years a comparatively small appropriation will add the additional two feet—much easier to obtain than was this original recognition.

The local benefits are enormous. An immense territory, with one of the greatest systems of natural waterways in the world, is landlocked, because there is no opening to the landlocked waters save through the canal to Chesapeake Bay. None of the inlets to the various sounds—Bogue Sound through Beaufort Inlet, Pamlico Sound through Whalebone, Ocracoke and Hatteras Inlets, or the upper end of Pamlico Sound near Croatan and Roanoke Sounds through New and Oregon inlets—is available, since these passageways are continually choked up with drifting sand, which piles up almost as fast as it is taken away, with the exception of Beaufort Inlet, where the waterway will empty into the ocean below Lookout. But Core Sound is so shallow that Beaufort Inlet, even if dredged without the construction of the waterway, would give no available inlet without great cost to the various sounds which form the inland water system of the North Carolina coast.



Lock of the Present Albemarle and Chesapeake Canal; to be Widened When Incorporated in the New Waterway.

THE NORFOLK AND BEAUFORT CANAL.

As the project stands at present, the surveys have all been made, and $550,000 appropriated to do the work on the third division; that is, the lower end of the route. This includes four miles of solid excavation from the Neuse River to Beaufort Inlet through Core Creek—the only solid excavation necessary in the entire route, if the Albemarle and Chesapeake canal forms a part of it. According to the estimate of the engineers in the last report, this excavation and the dredging necessary to open Pamlico Sound to the third division—to connect the sound to the ocean, in other words—would amount to:

Excavation, 4,120,000 cubic yards.
Length of cuts, 14 miles.
Cost at 12½ cents per cubic yard, $515,000.
Right of way, 600 acres at $25 per acre, $15,000.
Bridges, $20,000.
Total estimated cost, $550,000.
Total length of route, 50 miles.

The ideas in commencing work on the third division instead of the first are several in number. In the first place, it will immediately open the ocean to all the existing light-draft traffic of the various sounds. In the second place, it will immediately put behind the most objectionable part of the work, the solid excavation; and in the third place, it will allow plenty of time to make the purchase of the Albemarle and Chesapeake canal, or to lay plans for the digging

of the Cooper Creek canal, in the unlikely event that the canal could not be bought. There is no question that the establishment of the new route will make the Albemarle and Chesapeake canal a useless property, if its owners insist on retaining it, consequently it is considered a foregone conclusion that they will sell rather than suffer a loss. The price dictated by the engineers was simply the one which would be economical for the government to make the purchase with—and is in no way a "force-out price." It is, moreover, a large and therefore more than fair price for the length of cut it is designed to purchase.

The mechanical and engineering difficulties are few and small in number. The earth is soft clay and sand mixed, easy to remove with steam shovels and dredges. The climate is somewhat malarious, but the opening of almost all new waterways is that. Insect pests will probably prove a minor vexation. It is not known, and cannot be known, whether all the dredging excavations in the various sounds will result in permanent channels, particularly in the narrow Croatan Sound, where a stronger current and higher waves are met with than in any other place on the route. But the engineers recommended a maintenance plant, and a certain amount to be appropriated yearly for keeping the waterway open, rather than submitting this part of the work to contract; and such a recommendation will undoubtedly be adopted. If Croatan or Currituck Sound fills up the dredged channels, therefore, the maintenance plant will simply be kept busy upon them when necessary, dredging out what the waves and wind fill in, very much as dredges are almost continually at work on the large and important channels in the great harbors of the world.

The photographs show the character of the work to be done, and there is one class of structure which need not be repeated, namely, wooden revetment for the banks; this is admitted by the present Albemarle and Chesapeake canal management to have been an unnecessary investment and practically a waste of money.

Work will probably be started as soon as the season opens, and continued right along, further appropriations being called for as the work progresses. The entire waterway will be built, of course, by United States army engineers.

The British Naval Programme for 1907.

Pursuing the policy adopted for 1906, the British naval programme for the ensuing year shows a still further reduction, the estimates for 1907 being $7,135,000 below those of the preceding year. The total sum required for the naval defenses for the current year is $152,212,045, of which total the expenditure upon new construction will absorb $40,500,000, a reduction of $5,675,000 as compared with the appropriation to this end for 1906. According to the Parliamentary papers devoted to the question, many important innovations are to be made during the coming year, the most important feature of which is to be the creation of a new striking force to be known as the Home Fleet.

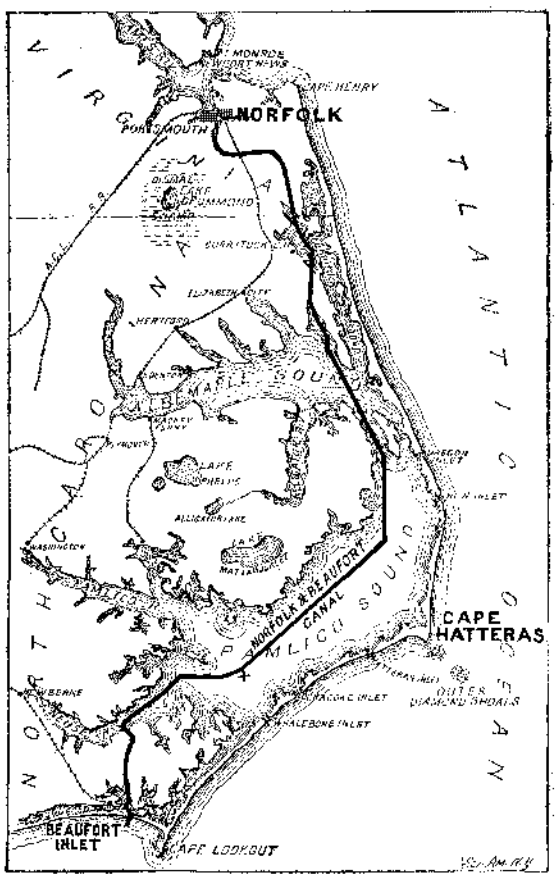
The constructional programme is of great importance, emphasizing as it does the complete success that has attended the evolution of the "Dreadnought" class of battleships. At least two similar vessels are to be laid down, the number to be increased to three should the coming discussion among the powers at The Hague Conference regarding the limitation of armaments prove abortive. These vessels will be of somewhat larger dimensions and displacement than the "Dreadnought," and the experience that has been gained with the latter vessel in regard to armament, details of construction, and motive power will be advantageously incorporated in the proposed warclads. Furthermore, an improved design of heavy gun, trials with which have proved eminently successful, is to be adopted for the arming of these vessels, but particulars concerning their caliber and so forth are withheld. In addition, 1 fast armored cruiser, 5 destroyers, 12 torpedo boats, and 12 submarines are to be commenced. With the exception of 1906, when no cruisers were laid down, the present is the smallest British cruiser programme on record. It is generally realized, however, that the coming of the "Dreadnought" class of battleship, which has not yet been fully proved, places the cruiser in a somewhat transient stage, and the present decision to limit strictly the number of cruisers is influenced by these conditions.

During the past year 4 first-class battleships, 3 armored cruisers, 11 submarines, and 7 first-class torpedo boats have been completed and passed into the fleet, while there are at present under construction 5 battleships, 7 armored cruisers, 17 first-class torpedo boats, 8 ocean-going destroyers, and 12 submarines.

During the trials of the "Dreadnought" great secrecy was maintained concerning the behavior of the turbines with which it is equipped; but that this propelling machinery is eminently adapted to naval requirements under all and varying conditions is substantiated by the statement that "the results obtained in the 'Dreadnought' and in the other turbine-propelled vessels which have been completed this year justify the adoption of this type of propelling machinery for his Majesty's ships, and this policy is being continued in all war vessels of this year's programme." It will thus be seen that the year 1906 marks an important era in naval engineering by the virtual passing of the reciprocating engine by the rotary motive power, so far as Great Britain is concerned.

The decision to constitute a new striking force by the creation of a Home Fleet, due to the readjustment of the balance of power in consequence of the Russo-Japanese war, is of far-reaching importance. By the distribution of the naval strength the present nucleus crews of ships in the first fighting line will be considerably augmented, while there will be complete manning of squadrons of six battleships and six armored cruisers which will not leave home waters. In addition to these 12 first-class ships, there will be 48 destroyers with full crews, some small cruisers, and the requisite auxiliaries concentrated at the Nore, and these will be maintained on a footing ready for any emergency. The term "in reserve" will no longer be applicable, since all sea-going ships in home ports not belonging to fleets or squadrons will become apportioned to the Home Fleet, and will be so maintained as to be able to proceed to sea with full crews at a few hours' notice.

During the past year a considerable improvement has been effected in regard to the gunnery. In battle practice, by which the gunnery organization of the ship as a whole is tested, and which is therefore the best criterion of efficiency, the average number of hits per ship was practically double that of the previous year, notwithstanding the fact that the 1906 tests were of a more severe nature, the mean range having been increased to 1,000 yards, and the time available for firing restricted to one minute or less.



Map Showing the Route of the Norfolk and Beaufort Canal for Which Congress Has Recently Appropriated $550,000.

In the gunlayers' test with heavy guns, the average number of points obtained per man was 80.065, representing an increase of 11.805 per man upon the previous year; or comparing the percentage of hits to rounds fired, it was 71.12 as compared with 56.58. With regard to the quick-firing guns, the percentage of hits to rounds fired rose from 21.63 in 1905 to 34.53 in 1906. In the battle practice of the torpedo-boat destroyers the increase was equally well maintained, the percentage of hits to rounds fired being 20.05 in 1905 to 34.6 in 1906. This improvement is general throughout the whole fleet, and is not confined to a picked selection of crack ships. As a result, the British fleet as a whole, both as regards vessels and personnel, is in a greater state of efficiency than it has been before for a number of years, and this improvement gives every prospect of being well maintained.

The United States Drainage Commission tests have shown that the best circumferential velocity for the impellers of centrifugal pumps is approximately 50 feet per second. This would represent, for example, a whirl velocity through the discharge of the impellers of, say, from 30 feet to 40 feet a second, which velocity must be slowed down to 12 feet per second or less in the discharge piping connected with the pump.

Correspondence.

The Moth and the Flame.

To the Editor of the Scientific American:

An interesting article, "The Moth and the Flame," which appeared in the Scientific American some time ago, is undoubtedly correct.

One night as I came upstairs to my room I heard the buzzing noise of a large number of moths beating against the window in trying to get through. It was very dark in the room, but the window was somewhat illumined by moonlight, and for that reason the moths were trying to get out by way of the window. I am satisfied that for them lightward means outward, while darkward means inward.

As soon as I struck a match, for the purpose of lighting the lamp, they all rushed toward it, apparently assuming that there was an opening.

After the match was out they flew around a little, and then returned to the window. As soon as I noticed this, I remembered what I had read, and tried the experiment again, with the same results.

When the second match was out, I lighted my lamp with a third one. After the lamp had been burning a few seconds, they left the window and rushed against the chimney again and again. This, according to my opinion, is pretty good proof of what the writer of the article mentioned above told the readers of the Scientific American some time ago.

New Braunfels, Texas. W. Mittendorf.

The New Army 14-Inch Gun.

To the Editor of the Scientific American:

According to the Army and Navy Journal, it is the intention of the Ordnance Department to build three 14-inch guns at once. This would indicate that the department intends to build these guns and mount them for service without subjecting one to an endurance test. If such is the intention, it seems to be a very unwise and dangerous plan, for an emergency might arise and these guns be found to be unfit for service after a very short action.

I am sure it is unwise to build the proposed 14-inch guns for many reasons to which you have called attention in your valuable paper, such as higher angle of elevation, shorter danger space and danger zone, heavier ammunition, longer time of flight, fewer shots in a given interval of time; to say nothing of the expense involved in building them. There is another and far weightier reason for not building them:—the object desired—a longer-lived gun—will not be obtained. Especially is this true if the department builds, as the chief of ordnance has reported it will, a 14-inch gun as light or lighter than the present 12-inch gun which it is to replace. I am sure it will be no longer-lived; in fact, I should not be surprised if it proved to be even shorter-lived.

The short life of a gun is due to scoring or erosion. This scoring results from two causes. The first you have several times pointed out, i. e., faulty obturation before and at the time the rotating band takes the rifling. The second cause, which increases the effect of the first cause and carries the effect farther down the bore, has been apparently overlooked by investigators of this question.

In building guns the bore is placed under a condition of initial compression either by shrinkage or by winding wire under a tension. In either way the effect is the same: the bore of the gun is made smaller by this compression. Now in action, the pressure of the powder gases tends to overcome this initial compression and so must enlarge the bore of the gun while it is at the same time compressing the heel of the shot. This leaves a space through which the gases rush past the rotating band and score the walls of the gun.

The first of these two causes has been recognized by Major Peirce, of the Ordnance Department, in his investigation of the scoring in shoulder arms. The effect of the second cause is not so great in the shoulder arms, for the reason that the scoring effect is overcome once the bullet is well seated in the bore, by the upsetting of the bullet by the pressure of the powder gases against its base, and the further facts that the bullet has a long bearing surface and a diameter of 0.308, while the diameter of the bore at the bottom of the grooves is but 0.306 and the shoulder arm is rifled with a uniform twist.

This expansion of the gun under pressure accounts for the fact that the scoring is greater on the lands than in the bottom of the grooves, for when the bore is expanded away from the shell by the powder pressure, the tendency of the gases to move in a straight line carries them across the lands which, offering the more vulnerable surface, are the more scored. It also accounts for the fact that with the same pressures and velocities the greater the bore the shorter the life of the gun, for under the same pressure a 12-inch gun would expand twice as much as a 6-inch gun and cause the gun to score at least twice as fast. This is true with the thickness of the